CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

JULY 15, 1944

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

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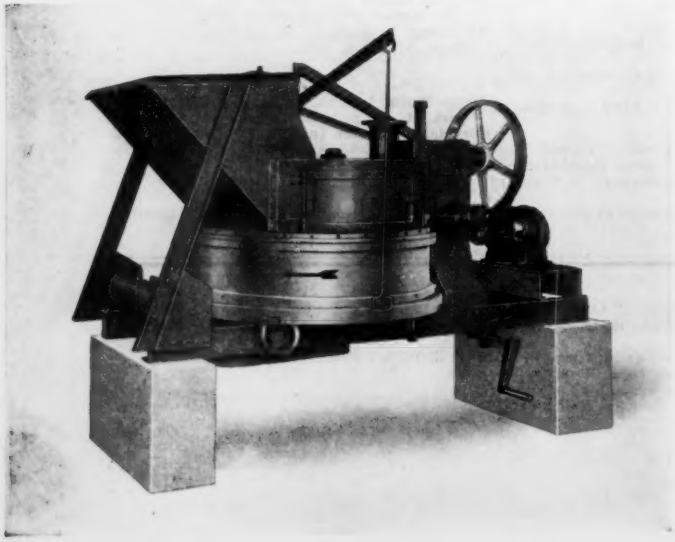

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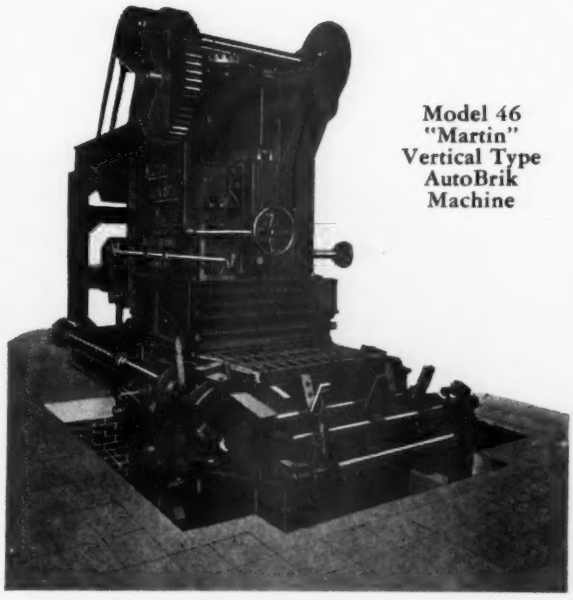

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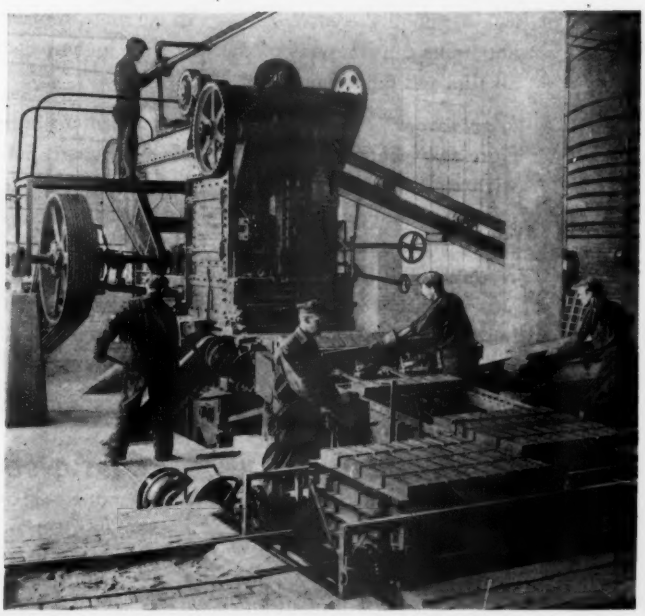

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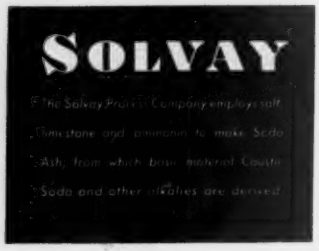

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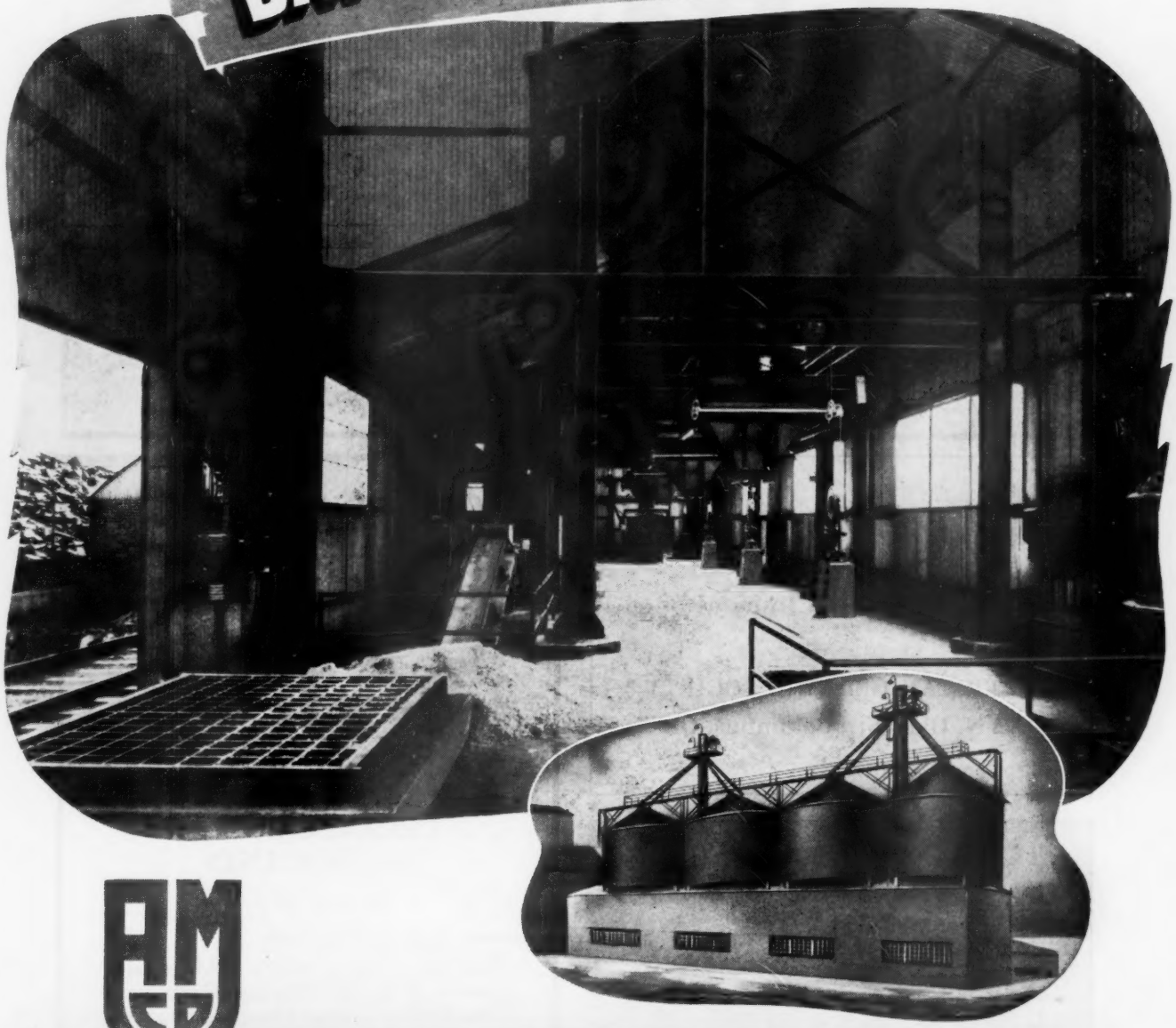

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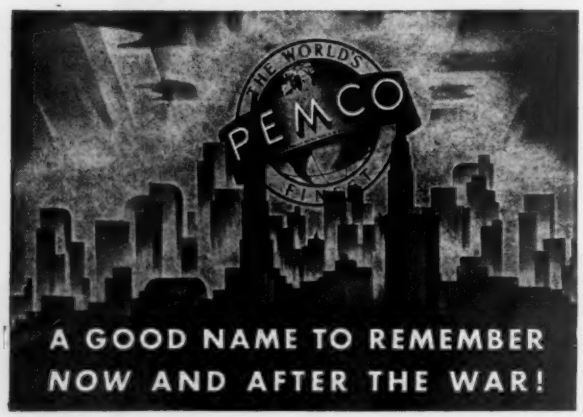

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Melting Area 440 Sq. Ft.	Total Days Life	Total Operating Days	Idle Days	Total Tons Flint Glass	Tons of Glass Per Sq. Ft. Per Life
7/3/41 to 11/11/43	860	844	16	62559.19	142.18
Down Period			13		
11/24/43 to 5/31/44 (Still Operating)	189	186	3	15613.58	35.48
TOTAL	1049	1030	32	78172.77	177.66

We will report to you, later, as to the outcome of this complete two-run campaign. As things appear now, we will be unable to give complete details until sometime in the first half of 1945.

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PERIODICAL REFERENCE: The name of the periodical appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 23 **July 15, 1944** **No. 7**

Abrasives

Diamond metal. ANON. *Ind. Diamond Rev.*, **4** [41] 85 (1944).—Recently it was claimed in the German press that diamond metal reduces the amount of diamond utilized and even replaces industrial diamonds. Diamond metal was invented by the German physicist W. Müller some years ago; it consists of a composite metal of fine layers of iron into which diamond grains are embedded. Although diamond-metal tools are cheaper than diamonds sintered in metals, their life is shorter. In spite of the inventor's claims, the diamond metal seems to possess no technical or economic properties that would make it rank before other diamond tools, especially sintered ones, and the German methods of reducing diamond consumption are not necessarily economical in countries with an abundant supply of industrial diamonds. P.G.

Diamond and sintered carbide dies. ANON. *Ind. Diamond Rev.*, **4** [41] 82 (1944).—Besides data on use, practical hints on repolishing practice are given. Repolishing is advocated for large diamond dies up to 2.64 mm. in diameter, giving greater output, better-quality wire, and a greater saving in die room. A drawing collar is polished out as soon as it develops without increasing the diameter, and the die is rebored to a larger size when the collar again develops. For reconditioning sintered carbide dies, 240-mesh boron carbide mixed with kerosene or a thin mineral oil is used. Time is shortened by using diamond powder, which also gives the final polish. Diamond powder is saved by using surplus powders left on dies or needles. Polishing sticks of wood wrapped with linen impregnated with diamond dust give a high polish in the shortest time. P.G.

Improvements in testing surfaces with reference to the bearing factor. W. DREYHAUPT. *Schleif- & Poliertech.*, **20**, 15–21 (1943); abstracted in *Feinmech. & Präzision*, **51**, 198 (1943).—Surface roughness and the bearing factor of a surface are characterized by various properties which are independent of one another. The surfaces limiting a body subjected to bending, tension, and other stresses without themselves carrying loads were formerly tested only for surface roughness. With surfaces such as bearings, which must transmit forces directly, the bearing factor has to be determined, and this is usually done by a method of extinction of the total reflection. Because of the great influence of deformation on the supporting bearing surface the testing conditions must be so arranged that the deformation of the tested surface does not vary. Based on the theory of elastic deformation, the type and extent of deformation are developed, and an improved apparatus is described which eliminates the faults of the older types by the use of a diamond prism. The modulus of elasticity of diamond is so high that there is practically no deformation of the testing prism. Furthermore, owing to the high refractive index of the diamond, the wave length of the transmitted light is extremely small (0.03 μ), and the faults of the bearing surface down to 0.03 μ can easily be determined. The high refractive index also makes the diamond in the testing process less sensitive to any traces of fat or liquid. P.G.

Industrial diamonds. F. G. ROCKWELL. *Mining & Met.*, **25** [449] 257–59 (1944).—Industrial uses of diamond dust or powder and stones are reviewed. The extensive use of cemented carbide tools has resulted in greatly increased needs for bonded diamond wheels. Africa, Brazil, Venezuela, and British Guiana are the chief sources of diamonds. In most cases, the producing countries have reached the peak of their production. B.C.R.

Mechanics of fine optical surface grinding. J. FLÜGGE. *Feinmech. & Präzision*, **47** [14] 191–95 (1938).—To obtain a high relative flatness by grinding and polishing, certain factors must be considered. For surface grinding it is important that the tool and workpiece move in correct relation to each other. The mechanical theory of optical grinding machines is expounded in detail. The correct pressure can be determined only by experience. P.G.

Microtopography of diamond and sapphire surfaces. J. F. KAYSER. *Ind. Diamond Rev.*, **4** [41] 72 (1944).—Sawed surfaces and polished surfaces were investigated. A Vickers projection microscope was used for taking the interferograms. Because of roughness and unevenness, sawed surfaces were investigated at relatively low magnification. Illustrations are given of a cleavage surface of a diamond needle accidentally broken, a sawed diamond surface showing the course of interference fringes, synthetic sapphire plates, a rectangular sapphire plate, a square endface of a Newall cube, and one pavilion facet

of an 8-carat brilliant. Detailed data of the interferograms are given. See *Ceram. Abs.*, **23** [4] 66 (1944). P.G.

Polished diamond tools eighty years ago. ANON. *Ind. Diamond Rev.*, **4** [40] 54 (1944).—The diamond was first used for truing hardened steel in 1867 by R. Robinson of the Observatory of Armagh for remounting his mural circle. In 1869 the use of diamonds to turn hardened steel was discussed in a technical paper, the *English Mechanic*. K. E. Kluge (1860), C. Holtzapffel (1842), and H. A. Miers (1902) are quoted on the subject. It is shown that polished diamond tools were used, even if not extensively, eighty years ago. See *Ceram. Abs.*, **23** [4 66 (1944). P.G.

Technique of high-speed grinding. E. MAY. *Feinmech. & Präzision*, **45** [20] 287–90 (1937).—The grinding wheel has been found to be the most suitable tool for the production of precision threads. If the correct hardness is chosen for the grinding wheel, it has a resharpening action, especially in the case of metals. Generally, three kinds of grinding wheels are used: (1) for grinding high-speed steel, (2) for grinding hardened, alloyed tool steels, and (3) for grinding alloyed constructional steel. Profile wheels are discussed, and machines used are illustrated. P.G.

Testing grinding wheels. G. PAHLITSCH. *Schleif- & Poliertech.*, No. 1/3 (1941); abstracted in *Ind. Diamond Rev.*, **2** [19] 32 (1942).—The test consisted in grinding sintered carbide tips of tungsten carbide G_1 (plain tungsten carbide with approximately 6% C and 60% Co, specific gravity 14.7) and steatite (magnesium silicate). The results were as follows: (1) Wearing capacity. (*a*) Pressure: The wear per minute increases with *B* (Bakelite) and *M* (metal) wheels (in the case of tungsten carbide) more or less proportionately with the pressure. *M* wheels can sustain a higher pressure per unit than *B* wheels. (*b*) Speed: The average wear increases progressively for tungsten carbide and steatite in the case of *M* wheels, but the *B*-wheel speed has only a slight influence on the wear. (*c*) Size of contact area: The wear of *B* wheels is reduced with increased contact area, whereas it increases with *M* wheels. (*d*) Lubricant: In the case of *M* wheels this has no practical importance. When grinding tungsten carbide with *B* wheels, the wear when using paraffin oil is greater than with water, and when cutting dry it is greater than with paraffin oil. In the case of steatite the order is reversed. (2) Grinding-wheel wear and diamond consumption. The wear of *B* wheels is a multiple of that of *M* wheels. (3) Chip formation. Comma and bandlike chips could not be observed when grinding tungsten carbide with diamond wheels, but the diamond grain is in a position to cut through the lattice of sintered carbides (tungsten carbide or tungsten carbide + titanium carbide); it is cutting as well as scratching. (4) Surface temperature of wheels. *B* wheels take a somewhat higher surface temperature than *M* wheels. (5) Quality of cutting edge. *B* wheels and *M* bronze wheels produce a better-quality surface on tungsten carbide than wheels composed of a metal alloy (no specification given). The surface quality obtained with boron carbide (B_4C) approaches that of the diamond. Best cutting edges were obtained by lapping the edges of the tools from both sides (apparently on both clearance and rake surface) with loose diamond grain. The most favorable speed with reference to surface quality seems to be about 2000 ft. per min. W. REUTHE. *Schleif- & Poliertech.*, **19**, 10 (1942); abstracted in *Feinmech. & Präzision*, p. 179 (1943).—Three different methods of testing the hardness of grinding wheels are reviewed. The first method makes use of a cone-shaped test needle which, with the help of an automatic punch, is pressed into the grinding wheel. The diameter of the generated hole can be read by a similar needle on the dial gauge and gives a measure of the penetration depth of the needle into the wheel and thus an indication of the hardness. The second method uses a drilling tool made of steel with a definite number of rotations and a definite drilling pressure. The size of the hole drilled in units of time is used as an indication of the hardness. In the third method a measured quantity of sand of uniform grain size is blown by pneumatic pressure through a jet onto the grinding wheel. In this case the depth of the depression formed by corrosion is used as the indication. The first method is unsuitable as an absolute hardness test for grinding wheels, as it does not permit the correlation of a given grinding wheel to a definite penetration depth of the needle. The greatest disadvantage is that when the apparatus is placed, the testing needle may meet a grinding grain or the bonding material. The results therefore do not agree in general. The drilling method was also found unsuitable. The specially pointed twist drill used as a tool is worn so much after 25 sec. testing time that under the same working conditions the second hole becomes much smaller than the first one. This disadvantage is said to be present in all testing methods working with cutting tools. An accurate measurement is possible only when the tool renews itself after every test. This is the case with the third method (Mackensen), which is considered the most successful. It gives an objective means for testing the hardness of grinding wheels. When using blowing pressure, following a hyperbolic law in relation to the grain size of the grinding wheel, the measuring results agree favorably; therefore for every grinding wheel a certain blowing depth can be correlated independent of its grain size. R. suggests replacing the usual Norton scale by a series of hardnesses expressed in blowing depth, but these investigations are not yet so far advanced that accurate data can be given. H. ÖPITZ AND J. RUMBACH. *Tech. Z. prakt. Metallbearbeitung*, **52**, 177–81, 221–27 (1942).—Sixteen methods for testing grinding wheels, as suggested in patents and literature, are described and criticized. The truing method according to Bornemann (doctor thesis, 1931) is discussed. In this method the diamond is pressed against a flexible support, and during the truing operation it becomes deflected from its ordinary position. The deflection is in relation to the tangential force applied, and it can be measured electrically (induction method) or mechanico-optically; the latter method was used by Rumbach in this investigation. The device is fixed to the table or attached to the grinding machine as is the ordinary truing device; it is calibrated by weights. During the extensive tests, the structure changes of the grinding wheel were tested by the so-called printing method, and the removed abrasive dust was analyzed by 25- to 200-mesh sieves. The grinding wheels ranged in grain size from 38- to 80-mesh and in hardness from *I* to *Q* (most probably according to the Norton scale). These new investigations contradict the assumption of Bornemann that the cutting pressure depends only on the hardness of the wheel and is independent of cutting depth, feed, and peripheral speed. The cutting pressure depends further on the grain size and the ability to splinter of the grain material. As a basis for the judgment of grinding wheels, therefore, the specific cutting capacity was chosen. It depends only on the product of $p \cdot v$ (cutting pressure · peripheral speed) when cutting depth and feed remain constant. The value $p \cdot v$ increases with the hardness of the abrasive wheel, the peripheral speed, finer mesh size, and greater ability of the abrasive grains to splinter. A nomogram is given which permits the determination from the cutting pressure of a measure for the hardness of the grinding wheel. As the size of the worn area of the diamond influences the measuring result considerably, it is necessary to use for these tests a diamond piece of constant cross section embedded in bronze. C. KRUG. *Schleif- & Poliertech.*, **20**, 31–34 (1943); abstracted in *Feinmech. & Präzision*, p. 179 (1943).—When the hardness grade has been determined for a definite grinding operation and a definite grinding wheel, the latter can be tested by the Mackensen method; thus any deficient wheel is found and excluded. It is not yet possible, however, to determine the general efficiency of the wheel from the hardness grade. A wheel recognized as deficient for a particular job by the Mackensen test can, by small alterations in the operating conditions, still be utilized as a first-class tool. The factors on which the effective grinding action of a grinding wheel are dependent are stated. P.G.

Time and rate fixing on grinding-wheel truing. F. L. MEYENBERG. *Ind. Diamond Rev.*, **4** [41] 78 (1944).—Rate fixing for grinding operations is a difficult problem owing to numerous influencing factors. The grinding time may, in general, be divided into adjustment and piece time. The truing time itself may be divided into (1) bringing the truing device into operation, (2) moving the table, (3) feeding the wheel head, (4) starting the cooling system, (5) truing the grinding wheel, (6) disconnecting the cooling system, (7) withdrawing the wheel head, and (8) removing the diamond. One pass along the face of the grinding wheel requires a main time, $t = L/(f \times N) = L/F' = L/(12 \times F)$ min., where L = width of grinding wheel + allowance of overtravel of 0.5 to 1 in., N = speed of grinding wheel in r.p.m., f = infeed per revolution, F' = feed in in. per min., and F = feed in ft. per min. In the case of centerless grinding, it is necessary to make a distinction between the infeed and the through-feed method. In the first case, the main time depends chiefly on the amount of material to be removed and type of material used, while in the second case the circumferential speed of the regulating wheel and its inclination have considerable influence. It is possible to obtain approximate data on truing times for rate-fixing purposes, but as there is still much uncertainty about these figures they should be used only as general guides. Sparse data contained in literature for circular, internal, and centerless grinding are compared. P.G.

PATENTS

Abrading tool. I. J. SNADER (Ex-Cell-O Corp.). U. S. 2,349,994, May 30, 1944 (July 28, 1941). C. E. ARCHER (Ex-Cell-O Corp.). U. S. 2,349,995, May 30, 1944 (Feb. 27, 1942).

Abrasive article. R. R. RIDGWAY (Norton Co.). Can. 420,263, May 16, 1944 (April 25, 1938; in U. S. March 9, 1938). J. S. SMYSER, deceased (Minnesota Mining & Mfg. Co.). Can. 419,894, April 25, 1944 (Dec. 29, 1932). G.M.H.

Abrasive-belt joint. R. T. ARGY AND C. W. FOSS (Carborundum Co.). U. S. 2,350,861, June 6, 1944 (Sept. 24, 1942).

Abrasive and cutting tools and processes for the manufacture thereof. F. R. SIMMS AND COMPOUND ELECTRO METALS, LTD. Brit. 560,410, April 19, 1944 (Aug. 7, 1942).

Ammunition-abrading apparatus. H. J. HACKMAN (Remington Arms Co., Inc.). U. S. 2,350,553, June 6, 1944 (March 11, 1941).

Buffing wheel. G. R. CHURCHILL. U. S. 2,350,216, May 30, 1944 (Jan. 6, 1943).

Crankshaft grinder. W. H. MYERS. U. S. 2,349,108, May 16, 1944 (Feb. 25, 1941).

Flexible abrasive article. H. C. MARTIN AND J. B. AUST (Carborundum Co.). U. S. 2,349,365, May 23, 1944 (July 9, 1936; renewed Sept. 26, 1938).

Grinding machine. F. J. HORTON (Super Tool Co.). U. S. 2,350,234, May 30, 1944 (Nov. 9, 1940). MAX AHNERT (vested in the Alien Property Custodian). U. S. 2,350,710, June 6, 1944 (Dec. 12, 1941).

Grinding and polishing machine. L. L. HERCIK (Hill Acme Co.). U. S. 2,349,964, May 30, 1944 (June 20, 1941).

Grinding-wheel dresser. E. W. MILLER (Fellows Gear Shaper Co.). U. S. 2,348,354, May 9, 1944 (June 14, 1941). JOHN SNEED (W. F. Dalzen). U. S. 2,350,937, June 6, 1944 (Dec. 16, 1942); divided out of U. S. 2,308,317, Jan. 12, 1943 (May 12, 1941).

Grinding wheel feeding mechanism. C. G. FLYGARE AND W. F. JOHNSON (Norton Co.). U. S. 2,349,786, May 23, 1944 (Feb. 12, 1942).

Honing arbor. JOSEPH SUNNEN. U. S. 2,350,969, June 6, 1944 (Jan. 21, 1942).

Honing tool. J. E. KLINE (Micromatic Hone Corp.). U. S. 2,349,628, May 23, 1944 (May 3, 1940).

Lapping machine for wire-drawing dies. O. G. FERRIER. U. S. 2,350,023, May 30, 1944 (April 28, 1941).

Machine for grinding racks. S. G. BRADY (Gear Grinding Machine Co.). U. S. 2,348,281, May 9, 1944 (Aug. 10, 1942).

Means for forming and dressing grinding wheels. MORGAN JELLIS (Coventry Gauge & Tool Co., Ltd.). U. S. 2,350,897, June 6, 1944 (April 9, 1943).

Metallic composition and abrading tool of the composition. J. T. KELLEHER (one-half to American Optical Co. and one-half to Neveroil Bearing Co.). U. S. 2,349,825, May 30, 1944 (Sept. 26, 1942).—A metal composition for use in forming a sintered metallic bond for abrasive particles consisting of a mixture of more than 50 and less than 95% chromium, more than 1 and less than 30% copper, and more than a fraction of 1 and less than 40% nickel, with the percentages of copper and nickel being decreased only when the percentage of chromium is increased and with the percentages of the copper and nickel being varied with respect to each other according to the combined balance of the metals required.

Porous abrasive article. H. R. HOUCHINS (Carborundum Co.). U. S. 2,348,474, May 9, 1944 (Feb. 2, 1942).—The improved process of making abrasive snagging wheels which comprises treating abrasive grain of relatively large grit size with a wetting agent, placing the treated abrasive grain in a porous container, compacting the abrasive grain by subjecting it to vibration, forming a ceramic bond raw mix into a slurry with water, deflocculating the slurry, immersing the abrasive grain in the deflocculated slurry so as to allow upward penetration and saturation of the compacted grain by the slurry, subjecting the container holding the grain to vibration while the abrasive grain is immersed in the slurry, drying the saturated mass of abrasive grain, and firing the dried product to at least partially vitrify the bond.

Pulsating device and method of honing. J. E. KLINE (Micromatic Hone Corp.). U. S. 2,350,117, May 30, 1944 (Aug. 29, 1941).

Surface grinder and automatic control means therefor. J. A. HARRINGTON (Continental Machines, Inc.). U. S. 2,350,229, May 30, 1944 (Nov. 27, 1942).

Thread-grinding machine. FERNAND TURRETTINI (Soc. Genevoise d'Instruments de Physique). U. S. 2,349,477, May 23, 1944 (Dec. 8, 1942).

Universal tool grinding machine. E. H. WIEDMANN. U. S. 2,349,324, May 23, 1944 (Nov. 10, 1941).

Art and Archeology

Ceramics for the cripple child. HENRY EWERTZ. *Bull. Amer. Ceram. Soc.*, **23** [6] 189–92 (1944).—6 photos.

Design in glass. ANON. *Pottery Gaz.*, **69** [801] 142–43 (1944).—Individual pieces of decorated glassware recently exhibited at the Stourbridge School of Arts and Crafts are illustrated. E.R.V.

Design in the pottery industry. M. FORSYTH. *Pottery Gaz.*, **69** [801] 135–41 (1944).—Lack of freedom for the designers, imposed by the manufacturers, and the need for a higher degree of technical training for the designers are the chief factors which have prevented the production of better-designed pottery. E.R.V.

Effect of firing atmosphere on development of colors in ceramic glazes. WILLIAM F. MCDEVIT. *Jour. Amer. Ceram. Soc.*, **27** [6] 165–75 (1944).—22 references, 11 figures.

Glasshouse friggers: XII, Paperweights. T. TAYLOR SEAGO. *Pottery Gaz.*, **69** [801] 151 (1944).—The use of millefiori on Bristol paperweights probably developed from a Roman type. Three modern types of paperweight are briefly described. Illustrated. For Parts **VI–X** see *Ceram. Abs.*, **23** [2] 34 (1944). E.R.V.

Good design in pottery. A. E. HEWITT. Read before Design and Industries Assn.; *Pottery Gaz.*, **69** [799]

29–31 (1944).—The influence of good design and the necessity for increased educational facilities in the ceramic industry are discussed. E.R.V.

Importance of good design. A. E. HEWITT. *Pottery Gaz.*, **69** [800] 75–90 (1944).—Illustrated. E.R.V.

Looking back. G. FORSYTH. *Pottery Gaz.*, **69** [799] 25–28 (1944).—The British pottery industry in Roman, Anglo-Saxon, medieval, and recent times is discussed. Illustrated. E.R.V.

Rock paintings in Southern Rhodesia. L. CRIPPS. *S. African Jour. Sci.*, **37**, 345–49 (1941).—C. shows that claret, red, yellow, brown, black, and white were the colors used most in the figures in the order given. He concludes that all paintings are probably connected with funerary rites either of the painters or of others. The character of the figures is explained. V.L.B.

Surface ornamentation in antique pottery art. Terra sigillata and Greek black and red painting. T. SCHUMANN. *Ber. Deut. Keram. Ges.*, **23**, 408–26 (1942); abstracted in *Chem. Zentr.*, **1943, I** [9] 992.—In terra sigillata (Lemnian earth) and the Greek black and red painting, it is a question whether the surface is a glaze or an engobe. The pigment which is the basis of both kinds of surface ornamentation consists of an Fe oxide (Fe_2O_3 and Fe_3O_4) and other oxides, such as Mn, which cannot be detected analytically. Ornamentation of the terra-sigillata type can be made by using an especially fine, dilute, engobe slip containing alkali and obtained by repeated decanting, which dries to a smooth transparent surface film. Painting closely resembling the antique Greek can also be achieved by painting the unfired ware with a colloidal slip, firing first in an oxidizing and then in a reducing fire, and annealing in an oxidizing atmosphere. The probable manufacture of the antique ceramics at temperatures of 900° to 1000° in beehive-shaped furnaces is described. See "Producing. . . ," *Ceram. Abs.*, **17** [11] 358 (1938). M.V.C.

Unique contribution of ceramics to childhood education. MARTHA M. SHERMAN. *Bull. Amer. Ceram. Soc.*, **23** [6] 192–94 (1944).—2 references.

Van Dyck in England. E. CAMMAERTS. *Proc. Roy. Inst. Gt. Brit.*, **32**, Pt.1 [147] 217–30 (1944).—Van Dyck's visits to England had great influence on his later success, and there is a marked difference between his Flemish and his English styles. During his Genoese period he used *in-pasto* sparingly and gave it up entirely during the English period. In Genoa he also favored dark coloring, browns, golds, and dark reds, but in England he used blues, grays, and light greens. The tercentenary of Van Dyck's death in London took place in 1942. E.R.V.

PATENTS

Vase design. DANESI ART MFG. CO. Can. 13,708 to 13,713, April 3, 1944. G.M.H.

Cements

Additions of powdered rock to lean concrete. Resulting advantages. J. FAURY. *Inst. Tech. Batiment & Trav. Publics Circ.*, Ser. F, **1942**, No. 9, 22 pp.; abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—The addition of refined powdered rock in a dry state thickens concrete. When Seine sand is used, the amount of powdered binding material and ground rock is about 300 kg. per $m.^3$ of concrete. The addition is especially effective in lean concrete; moreover, cement is saved. The satisfactory results obtained in laboratory experiments were confirmed in practice. M.V.C.

Effect of calcium sulfate on cement. ANSTETT. *Inst. Tech. Batiment & Trav. Publics Circ.*, Ser. M, **1942**, No. 4, 4 pp.; abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—Literature on the subject is reviewed, and the causes of the disintegration of cement are discussed (works by Le Châtelier, Candlot, Deval, and Lafuma). The physical and chemical agents which injure cement and means of avoiding them are discussed. M.V.C.

Hardening of Sorel cement and magnesite without magnesium chloride. V. RODT. *Tonind.-Ztg.*, **65** [7] 61–62 (1941).—13 references. See "Setting . . .," this issue.

Importance of the grain composition of flux materials in the solidifying of concrete. A. STEOPOE. *Materialele de Constructie*, **2**, 73–86 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—When the content of fine sand is increased and there are no intermediate grain size fractions of flux materials present, the concrete is more easily worked, and the specific gravity and resistance to pressure are lowered. M.V.C.

Optimum grain composition of concrete. J. FAURY. *Travaux*, **26**, 131–38, 191–94 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—A theoretical discussion of the optimum grain composition of concrete is given, and the theoretical principles are applied to cases from practice. M.V.C.

Right cement makes for better acidproof structures. JOSEF M. ROBITSCHEK. *Brick & Clay Record*, **104** [4] 44–45 (1944).—Accelerated cements are resistant to liquids of any acidity; they are therefore adaptable to almost every industry utilizing corrosive chemicals. Movement of liquid through porous cement joints may be prevented by the use of an asphaltic membrane between the lining and the porous casing. Proper thickness of the lining will guard against lining failure due to stresses set up by excessive expansion of either the lining or the casing. The lining should have a water absorption of at least 3% to allow for sufficient penetration of the silicate for a proper bond. Inadequate knowledge of the physical and chemical properties of acidproof brick and silicate cements and lack of experience in lining designs frequently cause failures for which brick or cement receive the blame. B.C.R.

Setting of magnesite cement without the addition of binders. HEINRICH STELLWAG VON CARION. *Tonind.-Ztg.*, **65** [17] 167–68 (1941).—A discussion and supplementation of a paper by Rodt (see "Hardening . . .," this issue). H.T.

PATENTS

Gypsum plaster. H. F. GARDNER (Certain-Teed Products Corp.). Can. 420,088, May 9, 1944 (March 12, 1942; in U. S. March 6, 1941). Can. 420,089, May 9, 1944 (July 30, 1942; in U. S. Aug. 29, 1941). G.M.H.

Enamel

All-porcelain hospital. ELSA GIDLOW. *Finish*, **1** [2 & 3] 18–19 (1944).—The Grass Valley (Calif.) hospital, an all-porcelain enameled structure, is discussed in detail. 4 photos. W.R.B.

Changing of color of enamel. ANON. *Emailwaren-Ind.*, **19**, 92 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—The turbidity of enamel increases with the age of the enamel, just as in the case of glass, and white color tones become more yellowish. The cause of the probable internal conversion is not known. M.V.C.

Converting the enamel industry to materials native to Germany. PAUL WIESSNER. *Keram. Rundschau*, **50**, 316 (1942); abstracted in *Chem. Zentr.*, **1943, I** [9] 991.—The results obtained by replacing borax and opacifiers, such as antimony oxide and tin oxide, with substitutes are briefly reviewed. M.V.C.

Effect of the surface of the sheet on the adherence of enamels. ANON. *Emailwaren-Ind.*, **19**, 91–92 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—Mechanical and chemical pickling methods are described. M.V.C.

Enamel defects resulting from casting. C. DENNERY. *Bull. Assn. Tech. Fonderie*, **13**, 312–13 (1939); abstracted in *Chem. Zentr.*, **1941, II** [24] 2983.—Enamel defects on castings can be conditioned by the oxidation of the cast iron, hollow spaces, solid and gas-generating inclusions, the action of quenching, and the form and distribution of the carbon. The deoxidation of the melt alone is insufficient. The behavior during and after hardening must also be watched. Suitable deoxidizing agents are the alkaline and alkaline-earth metals, Al, Cu-Mg, and chlorides. Not only the easily visible hollow spaces but also the finely distributed microscopic and submicroscopic gas bubbles must be taken into consideration. With regard to the quenching action, it is necessary to know the content of S and Mn. The casting temperature and the method of cooling the cast iron are important factors for the type of C in the casting, i.e., whether it is in the form of graphite or compounds. See *Ceram. Abs.*, **19** [9] 210 (1940). M.V.C.

Enamelability of cast iron after sandblasting and blasting with steel filings. ANON. *Keram. Rundschau*, **50**, 279 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—When steel filings are used, they must be somewhat harder than the cast iron or metal base. Experiments proved that the adherence of the enamel to the casting is the same both for castings blasted with sand and for those blasted with steel filings. M.V.C.

Enameling defects on de-enameled ware. O. WAHLE AND A. FUNKE. *Glashütte*, **72**, 277–78 (1942); abstracted in *Chem. Zentr.*, **1943, I** [9] 991.—Tests showed that repeated enameling and de-enameling of sheet iron with a low C content usually did not impair the mechanical properties, but instead it improved them, apart from the unavoidable thinning of the sheet. A picture of a ground section showed a recrystallization, a certain refining of the grain, and removal of the "line" structure. M.V.C.

Porcelain-enameled heating unit. D. B. KIFT. *Finish*, **1** [2 & 3] 11–13 (1944).—A new high-temperature porcelain enamel is used for electric range burner units to replace the nickel-chrome alloy normally used. The enamel is applied in very thin coats to cold-rolled steel units. It does not soften or become tacky at operating temperatures. W.R.B.

Pusher furnace trays and baskets designed for longer life. W. A. HAKIN. *Amer. Machinist*, **88** [9] 102–104 (1944).—Examples of the design and operation of furnace accessories are shown, and their handling and maintenance are discussed with a view toward prolonging their life. M.HA.

Replacing the adhering oxide. VIELHABER. *Emailwaren-Ind.*, **19**, 101–102 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—V. reports experiments in which sodium thiosulfate was used instead of cobalt oxide and nickel oxide; sodium thiosulfate has a reducing effect and forms sodium sulfate. M.V.C.

Silicate in enamels. ANON. *Emailwaren-Ind.*, **19**, 97–98 (1942); abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—The importance of silicic acid and silicates in enamels is discussed. M.V.C.

Supervising the pickling bath. VIELHABER. *Beizerei* (in *Emailwaren-Ind.*, **19** [43/44]), pp. 21–22 (1942); abstracted in *Chem. Zentr.*, **1943, I** [10] 1102.—Testing the bath with a hydrometer is insufficient for determining the acid concentration; e.g., in an Fe-pickling bath the H_2SO_4 and the Fe salt in the following concentration combinations (H_2SO_4 (%)/Fe salt (%)) gave the same specific gravity of 1.25: 33/0, 10/6, 5/7, and 0/8. The acid concentration must therefore be determined separately. Control of the temperature is also important. The composition of the metal to be pickled and the type of forge scale are particular factors which condition pickling time and the concentration of acid. M.V.C.

PATENTS

Forming sinks. E. H. KOTCHER (Murray Corp. of America). U. S. 2,350,119, May 30, 1944 (Dec. 13, 1940).

Opacifier. G. H. MCINTYRE, M. J. BAHNSEN, AND B. J. SWEO (Ferro Enamel Corp.). Can. 420,103, May 9, 1944 (Feb. 12, 1940; in U. S. March 13, 1939). G.M.H.

Porcelain enamel ground coat. G. H. MCINTYRE AND E. E. BRYANT (Ferro Enamel Corp.). Can. 419,836, April 25, 1944 (Feb. 12, 1943). G.M.H.

Glass

E. Abbe. ANON. *Feinmech. & Präzision*, **48**, 40 (1940).—A short biography is presented on the occasion of Abbe's 100th birthday. He was the founder of the Carl Zeiss A. G. and inventor of an illuminator for the microscope, refractometer, homogeneous immersion system, apochromat, thickness gauge, comparator, focometer, binoculars, etc. See *Ceram. Abs.*, **18** [4] 98 (1939). P.G.

Alignment diagram based on the Lyle equation for chemical durability of glasses. D. G. MERRILL. *Glass Ind.*, **24** [11] 468–69 (1943).—To facilitate calculations based on the Lyle equation for the chemical attack of glasses by water (*Jour. Amer. Ceram. Soc.*, **26** [6] 201–204 (1943)), an alignment diagram is constructed of three scales for time, temperature, and attack; a grill for the two constants of the equation; and a reference line. Use of the chart is illustrated for (1) extrapolation of laboratory test results to service conditions, (2) evaluation of the constants, and (3) interpretation of data. Unless the conditions of an accelerated test are properly chosen, the results may bear little relation to the service behavior. A.P.

Art of making glass. C. D. STAINIER. *Pottery Gaz.*, **68** [798] 653–59 (1943).—S. discusses the origin of glass and glassmaking, the Portland vase, glass-blowing tools, and the manufacture of wineglasses and friggers, particularly in the Stourbridge district in the English Midlands. Illustrated. E.R.V.

Bottle plant institutes wartime employee training program. R. A. BLUNT. *Glass Ind.*, **24** [11] 470–71, 483, 486 (1943).—The Buck Glass Co. is answering the manpower shortage by hiring women and instructing them in glass faults and the influence of inspection on costs and on customer satisfaction. A course in foremanship was also given under the Training Within Industry Group of the War Manpower Commission. The necessity for training new employees will continue after the war. A.P.

Calculation of density: Criticism. S. R. SCHOLES. *Glass Ind.*, **24** [11] 472 (1943).—S. criticizes the Huggins and Sun method for calculating density (see *Jour. Amer. Ceram. Soc.*, **26** [1] 4–11 (1943)) as being too lengthy and complex, retaining more significant figures than glass analyses justify, and not giving close agreement with observed values. **Reply.** M. L. HUGGINS AND K.-H. SUN. *Glass Ind.*, pp. 472–73, 485.—The authors point out that (1) the simple additive theory gives good agreement only over a limited range; (2) different constants are required for different ranges of composition; (3) more than three significant figures are used only where the data justify; and (4) their second method gives as good agreement as the additive formula for the limited composition range checked by Scholes and greater accuracy over a wider range of silica contents. A.P.

Calculation of surface tensions of glasses. K. C. LYON. *Jour. Amer. Ceram. Soc.*, **27** [6] 186–89 (1944).—7 references, 2 figures.

"Coated" ophthalmic lenses. C. F. SHEPARD. *Optician*, **107** [2763] 87–88 (1944).—Although the loss in transmission because of reflections is of minor importance in ophthalmic lenses, the annoyance and cosmetic disturbances of reflections are likely to stimulate a demand for lenses treated to reduce reflections. The acid extraction "dipping" methods first devised involve precautions to stop the process when the porous surface layer is at its optimum thickness. Of the variety of fluorides tried, magnesium fluoride seems most suitable. A light purple

tint of the reflected light is desirable. Lenses to be treated will need to be more highly polished than ordinarily. A.P.

Determination and measurement of stress in glass and other transparent bodies. H. BARTELS. *Feinmech. & Präzision*, **47**, 239–43 (1939).—Quantitative measuring and instruments therefor using circular polarized light are described. The difference of passage is determined by the position of the interference lines. The optical effect of the stress is increased by birefringence. Glass not only shows a small optical effect of stress, but it is also difficult to work on, while synthetics are cheap and can easily be brought into correct shape. P.G.

Development of Scottish optical-glass industry. ANON. *Optician*, **106** [2755] 382 (1944).—The discovery and exploitation of an excellent sand at Morven will favor an expansion of the Scottish glass industry. One hundred persons are employed by the quarry. With a slight adaptation of the process, the sand could be made the finest in Europe for optical-glass requirements. A.P.

Distinction not definition. ANON. *Glass Ind.*, **25** [1] 17 (1944).—The recent decision of the Federal Trade Commission enjoining the use of the term "glass" for organic plastics was based mainly on the viewpoint of the consuming public. Despite all definitions of glass and plastic, glass has won its day in court because of its distinctive properties. A.P.

Floor of Heaven. Definition of glass. F. W. PRESTON. *Glass Ind.*, **25** [2] 61–62, 88 (1944).—The word "glass" is an ancient one but of poor definition because it has been used in so many senses that it now means whatever the speaker wants it to mean. Any attempt at definition should state the purpose thereof and the limits within which the definition is expected to hold. Examples are given of definitions from the viewpoints of (1) the physical chemist, (2) the X-ray analyst, (3) the practical glassmaker, (4) law and commerce. They are definitions of a product, not of a word. The word "glass" and the adjective "glassy" have many meanings, and these meanings are legitimate in speech and literature. Only when it is applied to a product offered for sale do departures from the modern, exact definition become inadmissible. See "Definition. . .," *Ceram. Abs.*, **20** [6] 140 (1941). A.P.

Gayner Glass Works. An off hand-mechanized plant. C. B. DELGADO. *Glass Ind.*, **25** [4] 159–62, 182 (1944).—At its seventieth anniversary, Gayner Glass Works of Salem, N. J., is still being operated by the founding family. Although modern forming machines for container manufacture are utilized, hand blowing and pressing of carboys, battery jars, and other specialties still form a large part of Gayner's production. Twenty photographs include a continuous record of the blowing and finishing of carboys. A.P.

Glass fiber and its insulating properties. V. PUSHKIN. *Aviapromyshlennost*, **1940**, No. 8, pp. 47–49; abstracted in *Chem. Zentr.*, **1941, II** [24] 2983.—The many uses of glass fiber, including heat and sound insulation, air filters, and electric insulation, are explained and illustrated. M.V.C.

Glass processing wire and steel products. JOHN J. CAUGHERTY. *Wire & Wire Products*, **19** [5] 299–303 (1944).—A review of patents. Hot rods from the finishing pass are sprayed with molten glass to insulate the rod against oxidation during cooling; as the rod cools below oxidizing temperatures the glass coating separates, removing any loose oxide with it. Patents also cover the use of molten glass for wire drawing, galvanizing, annealing, and patenting. Instructions are given for the use of an experimental unit. B.L.

Glass Science, Inc. ANON. *Glass Ind.*, **25** [3] 115, 128 (1944).—Incorporation papers and bylaws of the new glass research institute have been filed. They are outlined to show the functions and purposes of the organization. See *Bull. Amer. Ceram. Soc.*, **23** [5] 176–77 (1944). A.P.

Glassmaking and lens design. ANON. *Optician*, **107** [2767] 153 (1944).—Advances in lens design have led to a demand for new optical glasses with optical properties different from those available hitherto. Recent papers on this topic are reviewed (see "Optical Workshop . . .," *Ceram. Abs.*, **23** [4] 71 (1944)). A.P.

History of Zanesville glass industry. GRACE GOULDER. *Amer. Glass Rev.*, **63** [33] 10 (1944).—The bottle collection of Everett S. Geer, superintendent of the Hazel-Atlas Glass Co. Zanesville, Ohio, plant, brings out the histories, locations, and stories of Zanesville's early factories and the workers in them. The first glass was made in Zanesville in 1815. A.P.

International glass situation. ANON. *Glass Ind.*, **24** [10] 421 (1943).—Purely trade matters affecting our postwar position involve the extent of domestic competition from imports, the volume of export sales, and the degree to which American glassmen participate in the development of new industries abroad, particularly in Latin America. A.P.

Light in Leningrad. ANON. *Optician*, **106** [2746] 232 (1943).—The Optical Institute at Leningrad is still functioning under siege conditions. Seven departments—spectroscopy, applied optics, optical instruments, computation, opto-chemistry (glass and other media), photometry, and photography—normally employ 250 scientists and up to 10 other employees per scientist. E. M. Brumberg has continued his work on color microscopy by ultraviolet light, which promises to open a new field of investigation. A.P.

Machines for the formation of glass connections in the high-vacuum technique. W. ESPE AND H. KOSAK. *Feinmech. & Präzision*, **46**, 329–34 (1938); **47**, 1–6, 29–34 (1939).—The high-vacuum industry uses many products which consist partially of glass. Glass tubes are still produced partly by hand, i.e., without any special machinery, but glass vessels are usually produced by machinery. The glass tubes, when blown into the correct shape, are sorted, cut, and washed before being used for further production. A detailed description of many glassforming machines is given. The most important point in the manufacture of first-class products is the correct size of flame used. Nitrogen, oxygen, or hydrogen can be used, each at a definite temperature. One of the most important processes is the manufacture of plate glass, which is illustrated. Some glass piston forming machines are described. The production of lamps is discussed. The duration of heating before, during, and after the operation depends on the form, size, and kind of the glass piece. In special furnaces, the temperature can easily be regulated. After the operation, the air is pumped out, and the name of the firm is stamped on the product. During the whole process, the worker must take care to avoid accidents, as an open flame is used, explosive gases are employed, and the dust formed is dangerous to the lungs. See "Glass. . .," *Ceram. Abs.*, **17** [2] 63 (1938). P.G.

Machining of Mycalex. NAGEL. *Werkstattstechnik und Werksleiter*, **33**, 509 (1939); abstracted in *Feinmech. & Präzision*, **48**, 48 (1940).—Mycalex is an inorganic material consisting of mica and glass. Parts are machined from plates and bars by means of turning, drilling, milling, tapping, sawing, and grinding operations. Optimum values for cutting speed, feed, and cutting angles are given. The special working conditions are mentioned. Owing to the lead content of the material, the dust caused during machining should not be inhaled, and a good dust-removing plant should be provided. P.G.

Mechanism of glass cutting. H. JEBSEN-MARWEDEL AND K. VON STÖSSER. Translated in *Glass Ind.*, **25** [1] 23–25; [2] 68–69, 80 (1944); see "Cutting. . . ," *Ceram. Abs.*, **18** [7] 177 (1939). A.P.

Metallurgical study of cast iron for glassforming molds. W. H. BRUCKNER AND HARRY CZYZEWSKI. *Trans. Amer. Foundrymen's Assn.*, **50** [1] 287–321 (1942); see *Jour. Amer. Ceram. Soc.*, **25** [13] 381–88 (1942). H.E.S.

Microanalytic methods for the investigation of glass. M. NIESSNER AND F. KORKISCH. Translated in *Glass Ind.*, **24** [12] 518–19 (1943); **25** [1] 21–22, 41 (1944); see *Ceram. Abs.*, **20** [10] 235 (1941). A.P.

New Texas plant of Owens-Illinois. ANON. *Glass Ind.*, **25** [5] 218–19 (1944).—From two Owens suction machines and three feeder-type machines, the Owens-Illinois Glass

Co. plant at Waco, Texas, has been producing nine million containers a month since its opening Jan. 3, 1944. Plans call for a doubling in capacity. 7 photos. A.P.

Optical data for 8-mm. film projectors. H. WEISE. *Feinmech. & Präzision*, **51,** 15–17 (1943).—Optical data are given for projectors of the following firms: Agfa, Ditmar, Dralowid, Eumig, Kodak, Nietzoldi & Kraemer, Siemens, and Zeiss-Ikon. Bibliography. P.G.

Optical glass from the viewpoint of the lens designer. R. KINGSLAKE. *Jour. Amer. Ceram. Soc.*, **27** [6] 189–95 (1944).—4 references, 10 figures.

Optical mathematics. J. FLÜGGE. *Feinmech. & Präzision*, **47** [5] 67–71 (1939).—Optical mathematics are part of scientific constructional and designing work. Constructional data for the optical system must be determined first on a purely theoretical basis so that they can afterward be used practically in the workshop. Various optical glasses have various physical properties, and the characteristics of the glass must be taken into account. P.G.

Owens-Illinois buys 80-acre site near Atlanta for 25th plant. ANON. *Amer. Glass Rev.*, **63** [33] 7 (1944).—A new bottle plant is to be built south of Atlanta, Ga., by the Owens-Illinois Glass Co. to serve the southeastern markets. Seven hundred persons will be employed when all furnaces are in operation. A.P.

Precision apparatus for rapid determination of indices of refraction and dispersion by immersion. C. A. FAICK AND B. FONOROFF. *Glass Ind.*, **25** [3] 110–12, 127 (1944).—Measurement of the Abbe value (ν) is essential in the control of optical glass; it presents a special problem because, for the necessary accuracy of ± 0.3, the index of refraction must be measured to the fifth place. In wartime it is necessary to have a control method which is accurate, speedy, and easy to manipulate. An improved immersion method has been developed which employs a double diaphragm for securing oblique illumination, light sources, a monochromator, collimator, immersion tank, telescope, precision refractometer, and accessories. Refractive indices for sodium D and hydrogen C and F lines may be obtained in about 1.5 hr., and from these the ν value can be calculated with an average error of 0.1 and a maximum error of 0.8. The apparatus is also applicable to finished optical components and to research on the effect of composition on optical properties, especially where the glasses may be unstable. A.P.

Present high peak of glass industry due to research. H. A. TRUMBULL. *Amer. Glass Rev.*, **63** [24] 9 (1944).—Consumer research activities of the Owens-Illinois Glass Co. through the panel, Home Makers Guild of America, has guided the design of glass packages. A.P.

Quality control. F. W. PRESTON. *Glass Ind.*, **24** [11] 474 (1943).—How far may it shortly become desirable to install quality-control techniques in plants manufacturing bottles or other glassware? A product "out of control" in the technical sense may be commercially satisfactory, but sudden trouble can cause serious losses, and the maintenance of excessive margins of safety is costly. The success of the "lightweighting program" proves the latter point. Present testing procedures serve as a warranty of the product that is sold but do not serve so well in providing data for factory operation or bottle design. The merit of applying quality-control techniques to testing procedures is under investigation. A.P.

Research in glass is horizontal at Preston Laboratories. C. B. DELGADO. *Glass Ind.*, **25** [1] 18–20, 38 (1944).—The technical research activities at the Preston Laboratories are not confined to glass containers. Wire, window, and plate glass, tableware, fibers, scientific glassware, and glass blocks are studied. Scientific problems outside the glass field are also undertaken. Eighty to one hundred papers have been published in scientific journals. Since 1938 three buildings have been added, and the staff has grown to thirty employees. 10 photographs. A.P.

Safety goggles corrective as well as protective. ANON. *Glass Ind.*, **25** [3] 116 (1944).—Four photographs illustrate the American Optical Co. production and testing of tempered lenses for safety goggles, including those ground to prescription to correct defective eyesight. A.P.

Significance of new data on combinations of plastic and glass fibers. F. W. PRESTON. Read at meeting of Society of the Plastics Industry, Chicago, May 11, 1944; quoted in *Amer. Glass Rev.*, **63** [33] 9 (1944). A.P.

Technology of light sources. A. DRESLER. *Feinmech. & Präzision*, **47,** 279–83 (1939).—D. reviews lamp manufacture. He mentions briefly the problem of melting hard glass and the advantages and disadvantages of glasses for gas-containing vessels and describes the economic position in respect to raw materials for the production of lamps and their general importance. P.G.

Training plane with glass-reinforced plastic fuselage, panels, tail cone proved in tests. ANON. *Amer. Glass Rev.*, **63** [32] 7, 19 (1944).—An Army training plane equipped with glass-reinforced plastic structural materials has completed successful flight tests. A balsawood core is sandwiched between skins of plastic reinforced with fibrous glass cloth. On a strength-weight basis, the new material is 50% stronger than metal and 80% stronger than plywood. Intricate shapes can be molded without high pressures, high temperatures, or expensive molds. Developments are expected in the automotive, marine, and building fields. See "Glass fibers reinforce. . .," *Ceram. Abs.*, **23** [1] 9 (1944). A.P.

Use of lead oxide in glassmaking refractories. A. E. BADGER, C. J. UHRMANN, AND A. C. OTTOSON. *Glass Ind.*, **24** [11] 465–67, 478, 486 (1943).—Surface tension plays an important role in the rate of disappearance of cords. Corrosion of refractories is an important source of cords. The addition of certain oxides to a soda-lime glass markedly lowers surface tension. Why not incorporate such oxides in refractories? Preliminary experiments with vanadium and chromium oxides indicated the validity of this reasoning (see "Vanadium . . . ," *Ceram. Abs.*, **20** [7] 168 (1941)). The proper use of lead oxide also improves the corrosion resistance of clay refractories without the coloring danger of chromium and vanadium; 6% PbO from lead silicate was best against soda-lime bottle glass at about 1400°C. and also accelerated mullite development. Up to 1450°C. no increase in flow under load was caused. No appreciable changes took place in apparent porosity and bulk specific gravity until 9% PbO was added. To decrease costs and insure against squatting, the lead oxide may be added only to an inner layer of the refractory or as a thin wash on optical-glass pots. For practical factory tests, 8 gathering rings containing 5% lead oxide were used in regular production. They averaged 16 melts, did not pit, and corroded more evenly. Lead oxide additions also accelerated the conversion of quartz to cristobalite in silica brick. A.P.

Wondrous glass. ANON. *Pottery Gaz.*, **69** [799] 17–23 (1944).—A general review of the history, development, and practice of spinning and weaving glass and the manufacture of cloths, tapes, yarns, sleevings, insulation, and battery separators. Illustrated. E.R.V.

SEPARATE PUBLICATION

Synthetic Optical Crystals. Published by Harshaw Chemical Co. Reviewed in *Bull. Amer. Ceram. Soc.*, **23** [6] 213–14 (1944).—5 illustrations, 16 references.

PATENTS

Apparatus for forming and annealing combination curved and straight glass. E. R. BOYLES AND C. M. PATTISON (Johnston Glass Co., Inc.). U. S. 2,348,279, May 9, 1944 (Dec. 26, 1940).

Apparatus for forming combination curved and straight glass. E. R. BOYLES AND C. M. PATTISON (Johnston Glass Co., Inc.). U. S. 2,348,278, May 9, 1944 (Dec. 26, 1940).

Apparatus for inside coating. M. E. MCGOWAN (Westinghouse Electric & Mfg. Co.). U. S. 2,349,444, May 23, 1944 (June 29, 1940).

Apparatus for producing a ground or ground and polished continuous strip of glass. F. B. WALDRON (Pilkington Bros., Ltd.). U. S. 2,348,581, May 9, 1944 (Oct. 8, 1943).

Bending glass sheets. J. L. DRAKE (Libbey-Owens-Ford Glass Co.). U. S. 2,348,887, May 16, 1944 (Dec. 13, 1940); divided out of U. S. 2,247,118, June 24, 1941 (June 2, 1938).

Glass cell electrodes and measuring apparatus for use therewith. G. KENT, LTD. Brit. 560,212, April 5, 1944 (Feb. 21, 1942).

Lamp-sealing apparatus. R. M. GARDNER (Sylvania Electric Products, Inc.). U. S. 2,349,822, May 30, 1944 (April 25, 1941).

Lens-edging device. L. W. GODDU (American Optical Co.). Can. 419,935, May 2, 1944 (Aug. 30, 1943).
G.M.H.

Making hollow glass articles. P. R. LUERTZING (one half to Walter O. Luertzing). U. S. 2,350,052, May 30, 1944 (Aug. 23, 1940).

Making hollow thermoplastic ware. V. E. HOFMANN (Owens-Illinois Glass Co.). U. S. 2,348,738, May 16, 1944 (Aug. 16, 1940).

Making mineral wool batts. V. E. MEHARG (Bakelite Corp.). U. S. 2,349,909, May 30, 1944 (Feb. 17, 1940).

Means for feeding articles, such as bottles, to a machine. T. HILL ENGINEERING CO. (Hull), LTD., T. E. HILL, AND N. C. HARRISON. Brit. 560,157, April 5, 1944 (Sept. 14, 1942).

Method of and apparatus for forming and finishing hollow glass bodies. P. R. LUERTZING (one half to W. O. Luertzing). U. S. 2,349,046, May 16, 1944 (Oct. 24, 1940).

Method and apparatus for shaping glass. J. J. HOPFIELD (Libbey-Owens-Ford Glass Co.). U. S. 2,348,905, May 16, 1944 (April 3, 1941).

Method and furnace for electrically melting glass. FRANÇOIS DUMAREST (vested in the Alien Property Custodian). U. S. 2,350,734, June 6, 1944 (April 10, 1942).

Method and means for carrying out the heat-treatment of glass articles. E. GREETHAM. Brit. 560,365, April 13, 1944 (Dec. 11, 1942).

Molten glass extruding apparatus. RUDOLF SCHARFNAGEL (vested in the Alien Property Custodian). U. S. 2,350,829, June 6, 1944 (June 14, 1940).

Multiple glass sheet units. A. RUNNERSTROM. Brit. 560,000, March 29, 1944 (Sept. 24, 1941).

Paste mold machine for forming hollow glass blanks into finally blown articles. B. H. KOOB (Hartford-Empire Co.). U. S. 2,348,347, May 9, 1944 (Sept. 5, 1942).

Process for manufacturing glass articles. A. G. C. KIRCHHEIM (vested in the Alien Property Custodian). U. S. 2,348,823, May 16, 1944 (May 26, 1939).—The method of fabricating a glass or vitreous building block.

Production of gathers of glass. W. B. MITCHELL. Brit. 560,405, April 13, 1944 (Sept. 18, 1942).

Treatment of glass surfaces. F. W. ADAMS (Pittsburgh Plate Glass Co.). U. S. 2,348,704, May 16, 1944 (Sept. 21, 1940).—A process of forming nonreflecting films upon a surface of a glass body comprising silica and base components for the silica, which process comprises leaching out the base components from the surface of the glass while leaving the silica in place to form a film consisting primarily of silica, the degree of leaching being such that the thickness of the silica film is slightly greater than one-quarter wave length of light, and then treating the silica film with hydrofluoric acid until approximately minimum reflectance is obtained.

Structural Clay Products

Brick and tile making in Gambia (West Africa). ANON. *Brit. Clayworker*, **52** [623] 145 (1944).—Experimental brickmaking trials by the Public Works Department on Gambia clay are likely to lead to new developments in the territory. Sun-dried brick and tile have been successfully made, and further trials on firing are in progress.
E.R.V.

Ceramics in building. HENRI LAFUMA. *Inst. Tech. Batiment & Trav. Publics Circ.*, Ser. E., **1941**, No. 1, 10 pp.; abstracted in *Chem. Zentr.*, **1943, I** [7] 770.—Fine and heavy ceramic products, their manufacture, and their uses in building are discussed.
M.V.C.

Efflorwick—for efflorescence tests of mortar materials and brick. ANON. *Brick & Clay Record*, **104** [5] 25–26 (1944).—Efflorwick, a standard wick developed by the Ceramic Experiment Station of the New York State College of Ceramics, consists of a cylinder of purified brick clay 2 in. in diameter and 4 in. high. In making the test, the wick is set in a glass dish containing the mortar or ground brick (20-mesh) to be tested and water. Twenty-five grams of mortar or 50 gm. of brick is added in 5- or 10-gm. increments, respectively, with 50-ml. portions of distilled water. All the water is permitted to evaporate before adding the next portion of sample and water. Twelve days are required to complete the test.
B.C.R.

Future of the structural clay products industry. L. R. WHITAKER. *Bull. Amer. Ceram. Soc.*, **23** [6] 194–95 (1944).—An editorial.

New bidding practice for building materials. ANON. *Heating & Ventilating*, **41** [5] 52 (1944).—The Producers' Council has proposed a new bidding practice for building materials, and the plan has the approval (in principle) of the American Institute of Architects. It may eliminate the "or equal clause" in future specifications and bring about alternate bids covering material brands not specified.
M.R.

Postwar ceramic construction. HERBERT V. KAEPPEL. *Bull. Amer. Ceram. Soc.*, **23** [6] 209–11 (1944).

Standardization of brick for buildings. E. SACHSE. *Z. Ver. Deut. Ing.*, **87** [45/46] 722 (1943).—S. proposes that solid and hollow brick be standardized on 25- x 12- x 6.5-cm. sizes; the material can be ordinary fire clay, lime sandstone, metallurgical brick, and light concrete. A few special forms are provided for roof constructions.
M.HA.

Refractories

Basic refractories for the copper industry: I. R. P. HEUER AND A. E. FITZGERALD. *Metals & Alloys*, **19** [5] 1133–36 (1944).—The development of basic-type brick, such as (1) Ritex process, (2) chrome-magnesia, (3) steel-clad, and (4) chrome-magnesia brick in which fine chrome grains are removed and the magnesia is in the fine fraction, is reviewed briefly. Because of more severe operating conditions of reverberatory smelters that have shortened the roof life from 300 to 400 days to 100 days or less, considerable interest has been shown in magnesite roofs, especially in the suspended type. An appreciable savings in refractories cost per ton of charge has resulted. Basic brick are replacing silica in the uptakes, front walls, and, in side-charge furnaces, the side walls.
B.C.R.

Better knowledge of raw materials widens usage of basic refractories. GILBERT E. SEIL. *Brick & Clay Record*, **104** [5] 39–41 (1944).—The deficiencies of crude chrome ore may be corrected either by a heat-treatment to disseminate the low-melting magnesium silicate throughout the ore or by the addition of magnesite to convert serpentine to forsterite. The destructive effect of lime in basic refractories may be minimized by maintaining a proper CaO/SiO_2 ratio, so that only $2CaO \cdot SiO_2$ may be formed. For small amounts of lime, sufficient silica may be added to form enough magnesium orthosilicate for diluting the dicalcium silicate in solid solution to minimize its deleterious effect. Dolomite is being used extensively as a source of magnesium and as a refractory when properly stabilized.

Open hearth steel production has increased appreciably, owing to the more extensive use of basic refractories in the furnace construction. B.C.R.

Calcination of topaz ore in a rotary kiln. GORDON R. POLE. *Jour. Amer. Ceram. Soc.*, **27** [6] 181–85 (1944).—6 references, 1 figure.

Cupola slagging of cast iron. M. FIELDEN. *Iron and Steel*, **16** [1] 3–4 (1942).—In general, cupola slags should contain not less than 25% CaO. In the production of castings which must be machined to a fine finish, a lime content of 35 to 40% will provide more satisfactory working conditions and results. Cast iron associated with hot lime-rich slag arrives at the spot so thoroughly cleaned that it carries well and does not unduly foul the ladles. When the slagging reactions are incomplete, the iron is "spotty," has poor carrying capacity, and is detrimental to the machinability and general soundness of castings. A.B.S.

Electrical resistance furnaces for magnesium alloys. W. E. SCHINZEL. *Giesserei*, **29** [23] 387–89 (1942).—S. discusses the adaptability and economy of electric melting furnaces for Mg alloys (Electron metal) on the basis of his experience, taking into account the cost of electrical energy, furnace design, and readiness for operation. Resistance furnaces have capacities of 60 and 110 kg. of Mg. Melting crucibles have an average life of 60 melts, which is equal to and sometimes better than that of gas melting furnaces. The greatest wear is observed at the outside by scaling. The usual furnace temperature is 900°. S. concludes that electrical heating is just as economical as other heating methods; the operator is not annoyed by gases, the material absorbs hardly any gas, and the mechanical properties of the material are very satisfactory. Operation and maintenance of the furnace is not more difficult than with other types, and repairs do not require an inadmissibly long time. Temperature control is easy. M.HA.

Magnesium from dolomite by ferrosilicon reduction. D. H. KILLEFFER. *Chem. & Eng. News*, **20** [6] 369 (1942).

Refractoriness and rating of molding materials. W. VASKA. *Giesserei*, **29** [18] 311–13 (1942).—A report of the (German) Committee on Questions of Molding and Core Sands deals with the influence of heat on molding materials in drying and casting and the effect of metal oxides on the surface of the molds. The refractoriness of several molding materials was determined by Seger cones before and after mixing 15% ferromanganese as a dust.

	Without ferro-manganese (°C.)	With ferro-manganese (°C.)	Difference (°C.)
Magnesite	1750	1750	
Lean molding sand	1710	1590	120
1/3 fat sand + 2/3 quartz sand	1660	1530	130
Binding clay (HVi)	1750	1320	430
1/3 fat sand + 2/3 slate	1660	1130	530

This shows that quartz grains which usually melt at Seger cone 34 (about 1750°C.) melt at a lower temperature if they come in contact with iron oxides (Fe_3O_4). When gray iron or steel is cast, the flowing metal oxidizes in the mold, and iron oxides and manganese oxide (Fe_3O_4 and MnO) are formed. At the surface of the mold and cores a reaction takes place by which easily melting Fe, Mn, and Al silicates (in the presence of clay) are formed. When organic substances, e.g., bituminous coal dust, organic binders, graphite, etc., are present, the sand grains are enveloped by them, and a protective layer is produced on the grains which prevents, to a certain extent, the melting together of the sand and the metal oxides and thus the baking of the sand to the casting. The generally accepted view that a material is more resistant to slag attack the greater its refractoriness is not correct. From the chemical viewpoint, a distinction must be made between the acid constituent, SiO, the basic constituent, Al_2O_3 (corundum), and their chemical compound, $Al_2O_3 \cdot 2SiO_2$, each of which has a different slag resistance. On the basis of these considerations, V. believes that a rating of molding substances alone is possible. M.HA.

Silicon carbide brick in melting operations. C. BRUCHHAUSEN. *Giesserei*, **29** [12] 208–11 (1942).—Silicon carbide brick are used as high-refractory material, often to replace sillimanite brick. Two grades are usually made, one with a medium silicon carbide content, corresponding in its properties to those of high-alumina products, and one with 85% SiC with properties which are unequalled by any other material. The refractoriness lies at Seger cone 40, far above the melting point of fire-clay or high-alumina brick. The compressive strength at ordinary temperature is also high (100 kg. per cm.^{2}). As the linear expansion is low, thermal stresses in the brick are small, especially in heating up a furnace. SiC products differ from all other refractory materials in their much higher thermal conductivity, and they are therefore used in special cases where good heat conductivity is important. Attention must be paid, in the use of SiC brick, to the particular property of the material of disintegrating in the presence of oxygen according to $SiC + 2O_2 \rightarrow SiO_2 + CO_2$, and care should be taken to protect the material from the oxidizing action of the combustion air. Fine grain reduces the oxidation, and a good protection has been obtained lately by applying a glaze on the surface. The material is particularly resistant to the dissolving action of slags, owing to its density. Examples of the arrangement of SiC material in the furnace to best advantage are given. M.HA.

PATENTS

Dead-burned magnesia. R. D. PIKE (Harbison-Walker Refractories Co.). U. S. 2,348,847, May 16, 1944 (Sept. 6, 1941).

Furnace-wall construction. W. H. BOYD (General Refractories Co.). U. S. 2,349,700, May 23, 1944 (Nov. 13, 1941).

Magnesium orthosilicate refractory. V. M. GOLDSCHMIDT. Can. 419,986, April 4, 1944 (Oct. 21, 1940; in Norway Dec. 21, 1939). G.M.H.

Refractory boiler wall. E. M. WILSON (Plibrico Jointless Firebrick, Ltd.). Can. 420,121, May 9, 1944 (June 17, 1942). G.M.H.

Refractory composition. C. J. KINZIE AND EUGENE WAINER (Titanium Alloy Mfg. Co.). Can. 419,736, April 18, 1944 (Feb. 29, 1940; in U. S. March 31, 1939). G.M.H.

Sealed heat-insulating block. LEROY JENNINGS AND H. C. BROWN, JR. Can. 419,525, April 11, 1944 (March 16, 1942; in U. S. Aug. 9, 1941). G.M.H.

Suspension for refractory walls. A. K. SPALDING. U. S. 2,348,314, May 9, 1944 (June 5, 1942).

Treating magnesium minerals. W. R. KLECKNER (J. A. McCarthy). U. S. 2,349,556, May 23, 1944 (Dec. 9, 1941.—A method of recovering values from magnesian ores containing appreciable amounts of minerals from the group consisting of bronzite, hypersthene, bastite, grünerite, cummingtonite, olivene, serpentine, meerschaum, steatite, enstatite, and forsterite which comprises subjecting the magnesian ore, while in a state of fine division and in motion, to the action of a reducing burner blast to calcine the ore to a temperature of between about 1200° and 1500°C., subjecting the calcined ore to magnetic separation to remove a major proportion of the iron content therefrom, and then subjecting the calcined ore from which the magnetically separable fraction has been removed to leaching with an acidulated aqueous medium to extract magnesium therefrom.

Whiteware

Action of high-frequency currents on the slip viscosity and rapidity of preparing bodies. A. I. AVGUSTINIK AND P. M. BRUSLINSKAYA. *Keram. Sbornik*, No. 7, pp. 44–46 (1940); abstracted in *Chem. Zentr.*, **1941, II** [24] 2983.—A report is given of tests in which porcelain slips were subjected to high-frequency currents and thermal treatment in a thermostat. The following conclusions were reached: The slip becomes less thick in the high-frequency field than in the heat field of the thermostat at the same temperatures and much less thick than under normal temperature conditions. The setting of the body in the plaster mold takes place much more quickly in the high-frequency field than in the heat field of the thermostat. It is evident that when a ceramic slip is subjected to a high-frequency current, not only is there a thermal effect, but also a heightened activity of the water molecules as well as a characteristic separation of the liquid and solid phases. See "Using. . .," *Ceram. Abs.*, **20** [9] 222 (1941). M.V.C.

British pottery exports. ANON. *Pottery Gaz.*, **69** [802] 195–99 (1944).—A statistical analysis of the European pottery export market before the war is given with suggestions for the expansion of British trade in the postwar years. E.R.V.

Choice of ceramics for electrical purposes. ANON. *Elec. Times*, **105** [2726] 72–74 (1944).—Various types of insulating and constructional materials available to the electrical industry are discussed, with a review of dry-process and wet-process porcelain, refractory, and steatite insulators. Illustrated. E.R.V.

*** Electrically conductive graphite paint.** A. N. NOVIKOV, T. A. RENSINA, AND E. D. FILYANSKAYA. *Vestnik Elektroprom.*, **12** [4] 32–34 (1941); abstracted in *Physik. Ber.*, **23** [17] 1669 (1942).—If certain parts of porcelain insulators are to be electrically conductive, the authors recommend using, instead of a sprayed-on metallic coating of Cu, Al, or Zn, a coating of flaky graphite (1200 gm.) with a maximum of 15 to 20% water, 2 to 3% ash, and 100 gm. oil lacquer with 40 to 50% film formers, diluted with oil of turpentine, benzine, etc. The coating is brushed on and is as resistant to mechanical impact or vibrations as Zn coatings. M.HA.

Influence of humidity on dielectric properties of high-frequency ceramics. HENRY H. HAUSNER. *Jour. Amer. Ceram. Soc.*, **27** [6] 175–81 (1944).—10 references, 10 figures.

Insulating materials of the HF. technique. R. RUDOLF. *Feinmech. & Präzision*, **47**, 265–67 (1938).—R. presents tables giving the electrical, mechanical, and thermal properties of insulating materials. With regard to thermal properties, ceramic materials have proved best. Their compressive and tensile strengths are lower than those of plastics, but the elastic properties of plastics are better. P.G.

Manufacture of porcelain with low firing temperature for the purpose of conserving coal. W. FUNK. *Sprechsaal*, **75**, 415–17 (1942); abstracted in *Chem. Zentr.*, **1943, I** [9] 992.—The manufacture of soft porcelain at Seger cone 7 to 10 for the purpose of conserving coal is reported. New possibilities in decoration have been realized. M.V.C.

Method of combining metal parts with ceramic substances. W. OSENBERG. *Feinmech. & Präzision*, **47** [4] 43–49 (1939).—The usual methods and disadvantages of combining metal parts with ceramic substances are described. The new electrothermic combination method consists in heating the metal part electrically between electrodes nearly up to the melting point of the metal used. The heated metal is then forced under a slight pressure into an opening in the ceramic substance; when it is cooled, they are found to be solidly combined. The ceramic body is not attacked by any strong pressure. The method has a big future in installation technique. Various older methods are compared. Machinery used for the purpose is described. Incorrectness can be balanced by suitable design of the ceramic substance. P.G.

* Obtained from microfilm.

Production methods for high frequency ceramic materials. H. BALKE. *Feinmech. & Präzision*, **51**, 5–13 (1943).—B. gives a thorough account of the problem of forming ceramic materials such as Calit, Frequenta, Condensa (Kerafar), and Tempa (Diakond). General considerations for the production, pressing, injection molding, casting and turning, glowing and glazing by firing, and finish machining by the use of sintered carbide and diamond tools are included. Operations such as circular, centerless, and surface grinding and lapping are discussed, together with obtainable surface finish, finish glazing, metallizing, and electrothermal upsetting. General recommendations for the design, including tolerances, are given. 41 diagrams and sketches. P.G.

Sanitary ware manufacture a postwar industrial opportunity for Tennessee. GEORGE I. WHITLATCH. *Tennessee Planner*, **4** [1] 1–8 (Sept.-Oct., 1943).—The South is producing the bulk of raw materials essential to the manufacture of high-grade ceramic ware but is almost wholly dependent on northern manufacturers for certain ware, particularly sanitary ware. By shipping ceramic raw materials to the North for fabrication, the Southern consumer, in purchasing the finished ware, is forced to pay a price that includes two long-haul freight charges. The solution for this highly uneconomic system of manufacture and distribution is the establishment in the South of plants to produce sanitary ware from the locally abundant raw materials. Tennessee, because of its geographic position, available resources, and other natural advantages, is an excellent location for this type of ceramic manufacture. Three of the four essential raw materials needed for sanitary ware are now being produced in Tennessee, and the fourth is readily available from nearby sources. Other economic advantages are adequate efficient labor, low-cost river transportation, and a central position in the major markets of the South and Southwest.

SEPARATE PUBLICATION

Dental Porcelain. HOWARD JOHN ORLOWSKI. *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 118, 34 pp. (March, 1944).—O. presents data that will be of value to the producers and distributors of dental porcelain and to dentists. He reviews the scientific literature on the subject and describes the artifices of dental-porcelain manufacture. The whole procedure of casting and forming the ware is foreign to ceramics. The process of treating a ceramic mix as a thermal-set plastic is ingenious and novel. The purpose of the work was to gather data relative to the use of nepheline syenite as the main component in a porcelain body mix. Glazes to fit such an unorthodox body (ceramically speaking) were developed. The study led to a consideration of glaze fit and appearance and to an investigation of the appearance of the bodies in ultraviolet light. Low fusing, insoluble, leadless glazes and frits were developed, with lithium oxide as an essential constituent. These glazes had maturing ranges of 1450° to 1650°F. Tooth porcelains of both the nepheline syenite and feldspar type should be fired under oxidizing conditions. A reducing atmosphere causes reduction in translucency and grayish colors in the porcelain. In the preparation of porcelain teeth by the vibratory method of packing, deairing is inadvisable because it produces a blebby structure. Fired tooth-porcelain specimens may be safely cooled to room temperature from a dull red heat by placing them under a Pyrex glass bowl. It is advisable not to cool the specimens at any faster rate than is accomplished by this method. Dental porcelain having a fluorescent characteristic near that of natural teeth was produced by the addition of a small percentage of a mixture of sodium uranate and thorium nitrate.

PATENTS

Making spark plugs. GENERAL MOTORS CORP. Brit. 560,516, April 19, 1944 (Jan. 23, 1942).

Manufacture of insulators of ceramic material. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 560,171, April 5, 1944 (June 16, 1941).

Method and apparatus for appendaging pottery ware. W. J. MILLER AND A. J. REEK (Reek assignor to Miller). U. S. 2,349,292, May 23, 1944 (May 7, 1941).

Preparing low-loss insulating material. E. L. DINNING, JR. U. S. 2,350,088, May 30, 1944 (May 29, 1942).—The method of producing low-loss electrical insulation which comprises firing a body of green steatitic material containing more than 2% by weight of iron at a temperature in excess of 1500°F. in a carbon-containing crucible and substantially excluding air and hydrogen from the body during the firing and subsequent cooling of the body.

Process for preparing ceramic masses. FRITZ GAREIS (vested in the Alien Property Custodian). U. S. 2,350,749, June 6, 1944 (Jan. 9, 1941).—The process of preparing moist but not pourable ceramic masses to prevent the formation of gases from contaminations contained therein which comprises admixing, before molding, water-soluble chemical substances to the masses adapted to act in statu nascendi on gaseous products of decomposition originating from the contaminations with the formation of nongaseous compounds.

Spark plug. C. M. CARINGTON, G. W. SHOOBERT, C. C. H. WHEATLEY, AND K. L. G. SPARKING PLUGS, LTD. Brit. 560,178, April 5, 1944 (Aug. 10, 1942). S. M. DOBROSAVLJEVITCH (vested in the Alien Property Custodian). U. S. 2,350,731, June 6, 1944 (June 25, 1940). BERNARD HOPPS (Lodge Plugs, Ltd.). U. S. 2,349,432, May 23, 1944 (Oct. 6, 1942). HECTOR RABEZZANA (General Motors Corp.). U. S. 2,350,475, June 6, 1944 (July 6, 1942).

Spark-plug electrode. J. R. GRETZINGER, A. J. BATTEY, AND HECTOR RABEZZANA (General Motors Corp.). U. S. 2,350,396, June 6, 1944 (Sept. 22, 1941).

Spark plug and method of making. TULLIO TOGNOLA (Bendix Aviation Corp.). U. S. 2,348,427, May 9, 1944 (July 9, 1940).

Ventilated radio-shielded spark plug. M. F. PETERS AND DAVID INGALLS (Titeflex, Inc.). U. S. 2,350,367, June 6, 1944 (April 6, 1942).

Equipment and Apparatus

Account of the first brickmaking machine. COLIN JOHNSTON ROBB. *Bull. Amer. Ceram. Soc.*, **23** [6] 213 (1944).

Design and use of optical measuring instruments. J. FLÜGGE. *Feinmech. & Präzision*, **47** [3] 35–38 (1939).—For correct results, the objective opening and the magnification must be determined for a diameter of the pupil of about 0.5 to 0.8 mm., as then the human pupil observes the smallest angles. The avoidance of mistakes arising from parallelism is very important; for this purpose it is best to use a telecentric diaphragm. P.G.

Elements of the telescope optic as basis of construction. R. PFANDER. *Feinmech. & Präzision*, **46** [1] 3–8 (1938).—After discussing the fundamental basis of the optics of the telescope, P. describes the astronomic telescope and the microscope. In the first case he mentions the different oculars (eyepieces) which are in use: Ramsden's, Kellner's, and the symmetric ocular. The determination for the distance between lenses with Ramsden's ocular is given. In the second case the reversible lens method and the reversible prism method are discussed. P.G.

Evolution of the crusher. W. E. FARRELL. *Pit & Quarry*, **36** [11] 61–62, 64, 118 (1944).—The use of crushed stone for highways and for ballast for railroads brought about the development of the crusher. The first U. S. Patent was granted in 1830 for a "machine for breaking stone and thrashing grain." F. discusses the various patents issued from 1830 to 1881 covering the transition of the crusher from a crude to an efficient machine. 2 photographs, 7 diagrams. M.R.

Jets with automatic control. H. G. BLEY. *Feinmech. & Präzision*, **48**, 31 (1940).—The calculation of a special valve shape for a constant volume independent of the pressure is described. P.G.

Metallic substances for thermoelements. A. SCHULZE. *Feinmech. & Präzision*, **47** [12] 169–76 (1939).—Le Châtelier's element is the most important of thermoelements made of precious metals. It consists partly of pure platinum and partly of an alloy of platinum and 10% rhodium; it is used for measuring temperatures between 300° and 1500° or 1600°C. The next in importance is Pallaplat's element, consisting partly of a gold-platinum-palladium alloy and partly of a platinum-rhodium alloy; it is used for temperatures between 1000° and 1200°C. Of base metals, the most important are those of silver-constantan, copper-constantan, and iron-constantan, which are used between 0° and 600°C. See *Ceram. Abs.*, **22** [8] 141 (1943). P.G.

Near infrared and metal finishing. PAUL H. KRUPP. *Metal Finishing;* reprinted in *Enamelist*, **20** [1] 12–22 (1942).—K. describes the use of infrared lamps for drying synthetic enamels and lacquer finishes. 9 illustrations. L.E.T.

Reflexless eye mirrors and refractometers. T. GRAFF. *Feinmech. & Präzision*, **48**, 27–30 (1940).—G. deals with the development of eye mirrors. The principle of Helmholtz is to send light rays in the same directions into the pupil in which the observation is carried out. Hitherto-used instruments are not free from reflexes; Busch (Rathenow) has recently developed a reflexless hand eye mirror according to the principle of Thorner for the observation of the correct picture. G. also deals with instruments for the reverted picture and with reflexless eye refractometers and their calculation. P.G.

*** Resistance thermometers with wire supports of quartz.** P. G. STRELKOV. *Zavodskaya Lab.*, **8** [10/11] 1097–1101 (1939); abstracted in *Physik. Ber.*, **23** [17] 1615 (1942).—The usual mica or porcelain carriers of Pt resistance thermometer wires are not sufficiently temperature resistant or are too bulky. Quartz rods 0.5 to 1 mm. in diameter have higher electric and thermal resistance and less volume and can be melted into quartz tubes. M.Ha.

Technique of television recorders. H. LORENZ. *Feinmech. & Präzision*, **48**, 13–17, 23–26 (1940).—A television apparatus, designated as Standard Television Receiver E 1, was shown at the 16th German Exhibition for Radio and Television, Berlin, 1939; it was developed by the German State Post Office in collaboration with the television industry. The design of this apparatus is described, and the development of the technique is dealt with after a short explanation of the process. The iconoscope and supericonoscope are described. P.G.

Testing method for projection and photo optics. R. PELZ. *Feinmech. & Präzision*, **47**, 197–98 (1939).—P. mentions briefly the testing conditions and the apparatus built upon them for kino-, dia-, and epi-objectives. The importance of optical mathematics is shown. P.G.

Use of the spectroscope in steelworks. JOHN CAMERON. *Jour. West Scot. Iron & Steel Inst.*, **51** [2] 15–27 (1943–44). B.C.R.

PATENTS

Apparatus for determining the total specific surface or the particle-size distribution of powdered materials. H. HEYWOOD. Brit. 560,037, March 29, 1944 (Sept. 10, 1942).

Machine for molding brick. C. W. WATSON. U. S. 2,350,298, May 30, 1944 (Jan. 5, 1943).

Piezoelectric-crystal apparatus. W. P. MASON (Western Electric Co., Inc.). Can. 419,886, April 25, 1944 (May 2, 1941). G.M.H.

Tippler apparatus for discharging the contents of wagons, etc. BRITISH REFRACTORIES RESEARCH ASSN. AND H. H. MACEY. Brit. 560,211, April 5, 1944 (Oct. 5, 1942).

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* Obtained from microfilm.

Kilns, Furnaces, Fuels, and Combustion

Can you afford not to install tunnel kilns? ANON. *Brick & Clay Record*, **104** [5] 17–18, 20, 48 (1944).—In slack seasons large tunnel kilns cannot be operated advantageously. When operating at 50 to 75% of capacity, their costs approximate those of periodic kilns. Flexibility in firing schedules may be obtained through the use of several small tunnel kilns. Some uncertainty exists as to the proper size and shape of tunnel kilns. The construction of many tunnel kilns is expected in the postwar period. See "Critical. . .," *Ceram. Abs.*, **22** [3] 56 (1943). B.C.R.

Colorimetric method for determining the water-vapor content in fuel gases. R. J. PFISTER AND D. J. KERLEV. *ASTM Bull.*, No. 127, pp. 17–22 (March, 1944).—A technique is described for determining moisture in fuel gases using the Evelyn photoelectric colorimeter. Results indicate that water contents may be determined to within ±3% of the true value. B.C.R.

Gas producers can help solve natural-gas shortage. R. F. FERGUSON. *Glass Ind.*, **24** [10] 424, 440–41 (1943).—Curtailment of natural-gas supplies indicates the importance of restoring producer-gas units to service. Before producer gas can be used, the gas regenerators and requisite flue systems must be reinstalled. If the gas is used only for glassmelting, cleaning is not necessary, and the cost can be kept down. Because of the low calorific value of producer gas, conversion results in about 20% reduction in pull and prevents sudden fluctuations in pull. The producer-gas flame is wide and has high luminosity. A.P.

Operating experiences with chromium- and nickel-free heating-conductor material in electric furnaces with hydrogen atmosphere. F. WESSELBURG. *Elektrowärme*, **12** [10] 143–46 (1942).—Carbon steel with 0.6% C was found to be a good material for heating conductors in electric furnaces in which both charge and conductors were in a hydrogen atmosphere. The heating-up time is shorter for the steel than for the alloy conductors. The transformation of the α-iron into the γ-iron occurring at 700° to 800°C. increases the resistance of the steel conductor to almost that of the Cr-Ni alloys. The gradually decreasing mechanical strength (observed up to 1060°C.), however, shortens the life of the steel conductor to one-fourth that of the alloy conductor, but in spite of this, economical advantages may be obtained in some cases. M.HA.

Proper utilization of gas a dual responsibility. C. GEORGE SEGELER. *Glass Ind.*, **24** [12] 513–16, 533 (1943).—Wartime conservation demands efficient use of natural gas in glass tanks and lehrs. A detailed analysis of possible wasteful practices can result in permanent savings. Glass plants should maintain a combustion engineering department to check regularly on the performance of all furnace equipment and instruments. A.P.

Time to check up on firing schedules. ANON. *Brick & Clay Record*, **104** [4] 19–22; [5] 22 (1944).—Drying and firing temperatures for various types of ceramic products are given. The tendency of numerous oxides to volatilize during firing is discussed. Decomposition temperatures and factors influencing the decomposition of iron sulfate, limonite, gypsum, limestone, and siderite are mentioned. Shrinkage and apparent porosity are factors commonly employed in determining the vitrification range of a ceramic body. Low shrinkage may be due to the presence of considerable nonshrinking material, underfiring, or overfiring. The firing rate should be reduced during the high-shrinking period. The porosity of fired ware is related in varying degree to strength, bulk density, permeability, thermal and electrical conductivity, thermal shock, and resistance to weathering, abrasion, erosion, slagging, discoloration, efflorescence, and chemical attack by gases, liquids, and fungus growths. Color generally deepens as vitrification progresses. Lime and, to a lesser extent, alumina exert a bleaching effect on iron oxide colors. B.C.R.

SEPARATE PUBLICATION

Performance of Pressure-Type Oil Burners. ANON. *Iowa State Coll. Eng. Expt. Sta. Bull.*, No. 151, 32 pp. (1941); reviewed in *Mech. Eng.*, **64** [2] 152 (1942).—An investigation of four high-pressure oil burners operated with various nozzles and cycling rates in both conversion and oil-designed boilers is reported. The apparatus and testing procedure are described, and detailed results are given, including the effect of various characteristics upon efficiency. F.G.H.

Geology

Conditions of deposition of the fire clays at Boksburg, Transvaal. V. L. BOSAZZA. *S. African Jour. Sci.*, **40**, 109–12 (1943).—The origin of bedded fire clays occurring below coals is discussed. B. suggests that they were deposited under arctic conditions in shallow marshes and close inshore in a shallow sea. The depths of water did not exceed about 60 ft. and probably averaged much less. The removal of the salt took place before and during the formation of coal, the sea bottom meanwhile having risen somewhat both by deposition and possibly by a general upward movement of the land. The possible depth of water is derived from observations of Russian hydrobiologists and by personal observation of the sedimentation of Nile waters in Lake Timsah. The genesis of the nonplastic clays and of those occurring in sinkholes in the dolomite remains to be investigated. Later researches indicate that the nonplastic fire clays may be aerial or subaerial deposits similar to those formed in Ayrshire, Scotland. Recently it has been noted that with increase of depth there is an increase in organic matter and that the iron content decreases with organic matter. This is probably due to the activity of iron bacteria. V.L.B.

Dependence of the swelling of clays on the pH of the solution. A. S. KORZHUEV AND Z. L. BORISOVA. *Kolloid. Zhur.*, **5**, 667–72 (1939); *Chem. Abs.*, **34**, 992 (1940).—The swelling of clays increases with the amount of small particles (below 10^{-4} cm.) in them. In NaOH or HCl, swelling is little affected by the pH between 3 and 11, and in AcOH-NaOH buffers, between 5 and 9; in strongly acid or strongly alkaline solutions it is larger than in neutral ones. See "Swelling. . .," *Ceram. Abs.*, **21** [9] 202 (1942).

Differentiation of magnesite from dolomite in concentrates and tailings. GEORGE T. FAUST. *Econ. Geol.*, **39** [2] 142–151 (1944).—A new method is presented for differentiating magnesite from dolomite in crushed materials. It is based on the essentially different temperatures at which these minerals undergo thermal decomposition. The resulting lowly birefringent periclase is easily distinguished microscopically from the highly birefringent dolomite. Ease of recognition of the periclase permits rapid counting and gives reliable quantitative data on mineral decomposition. Rock fragments 1 x 1 x 0.25 in. were heated in a furnace at 585°C. for 2 hr., cooled, and immersed for 2 min. in a 5% $AgNO_3$ solution. By means of a binocular microscope, the amount and distribution of dolomite can be determined. The magnesite stains black, whereas the dolomite is only slightly discolored. Kennedy reports a similar method for distinguishing brucite from calcite, the brucite being converted to MgO on heating and staining black (see "Dolomite. . . ," *Ceram. Abs.*, **22** [9] 161 (1943)). B.C.R.

Effect of the pH of the solution on the sedimentation of clays. A. S. KORZHUEV AND Z. L. BORISOVA. *Kolloid. Zhur.*, **5**, 475–82 (1939); *Chem. Abs.*, **34**, 922 (1940).—One part of clay was shaken with 5 parts of H_2O, and the sedimentation of the suspension obtained was observed. Some clays sediment at once, while others produce a

gradually increasing deposit. The effect of the pH is not uniform, although strong acids usually accelerate, and strong alkalis retard, the sedimentation.

Geological section at the limestone mine, Barberton, Ohio. CLINTON R. STAUFFER. *Amer. Jour. Sci.*, **242** [5] 251–71 (1944).—The combined shaft and diamond test holes provide a log of 2851 ft. in the important geological section of the Lake Erie region. Several disconformities and the indications of interrupted sedimentation are evident in shales and limestones encountered. B.C.R.

New Caledonian nickel. W. H. DENNIS. *Mine & Quarry Eng.*, **9** [4] 96–97 (1944).—A compilation on the discovery, location, and working of nickel and chromite in New Caledonia. E.R.V.

Rhyolite near Big Pine, California. E. B. MAYO. *Bull. Geol. Soc. Amer.*, **55** [5] 599–620 (1944).—A single mass of rhyolite in a basaltic field was formed by issuance from a structural intersection in the regional pattern. Obsidian was remelted and inflated to form gray lava and possibly pumice, with spreading during the period of increased heat and fluidity. A.C.B.

South Carolina, a state of opportunity. ANON. *Mfrs. Record*, **113** [5] 73–103 (1944).—The value of the major mineral products of South Carolina for 1940–1941 was $5,250,000; the high-grade white clay or kaolin produced in 1941 had a value of $1,596,471 alone. The state has rich deposits of nonmetallic minerals, and kaolin, clay, limestone marls, and phosphate rock are especially plentiful. Other minerals, such as sillimanite, spodumene, topaz, vermiculite, corundum, feldspar, etc., have been located. Manufactured products from stone, clay, and glass raw materials totalled $8,500,000 in 1943; the value of stone quarried in 1941 was slightly over two and a half million dollars. Much of this stone is crushed for use in building and highway construction. The building granite resists weathering and is of a high quality. Agriculture, industries, forests, shipping, railways, highways, climate, and other features of the state are also discussed. 40 photographs, 1 map, 1 table. M.R.

Staining tests for dolomite. G. VIBERT DOUGLAS, A. M. KING, AND J. O. MISICK. *Econ. Geol.*, **39** [1] 69–70 (1944). —By means of a 10% $FeCl_3$ solution, limestone may be stained a light brown, whereas dolomite shows no color. A confirmatory test may be made as follows: Mix the finely powdered sample with 5 ml. H_2O and 3 ml. of a 0.1% solution of titan yellow. After shaking, add 2 to 3 ml. of a 0.1 *N* KOH solution, shake well, heat to boiling, and cool. If the residue at the bottom retains its original color, magnesium is absent. A red color indicates the presence of magnesium. The color is less evident if the dolomite is impure. B.C.R.

Talc, steatite, and soapstone. F. B. MICHELL. *Mine & Quarry Eng.*, **9** [3] 66–70 (1944).—M. gives a general description of the nature, composition, distribution, production, and uses of the talc minerals, with special reference to those in Great Britain. E.R.V.

United States section of Pan American Institute of Mining Engineering and Geology formed. ANON. *Bull. Amer. Ceram. Soc.*, **23** [6] 208–209 (1944).

SEPARATE PUBLICATION

Industrial Waters of Canada. HARALD A. LEVERIN. *Can. Dept. Mines, Bur. Mines, Mines & Geol. Branch, Dept. Mines & Resources, Memorandum Ser.*, No. 85, 40 pp. (1944).—This is Interim Report No. 6 of a series of reports made on Canadian waters. It consists entirely of industrial analyses of the more important surface waters and of civic water supplies for towns of over 3000 population in eastern Canada and of over 2000 population in western Canada. See *Ceram. Abs.*, **21** [8] 178 (1942). G.M.H.

Chemistry and Physics

American Ceramic Society—Report of Committee on Research. ARTHUR A. WELLS, *Chairman*, AND JOHN H. KOENIG, *Secretary*. *Bull. Amer. Ceram. Soc.*, **23** [6] 195–204 (1944).

Application of zirconium silicates and oxides. ANON. *Brick & Clay Record*, **104** [5] 46, 48 (1944).—The physical properties of zircon refractories are given. Brick made of a grog-type mix are used in high-temperature applications, aluminum remelters, pot-furnace linings, chlorinator linings, reactor hearths, metal-pouring troughs, and spouts. Their excellent service in aluminum tanks is partly due to the inability of aluminum to wet the brick, thus minimizing chemical attack and metal build-up on the walls. The properties and uses of zircon ramming mixes, washes, cements, and casting cements are given. B.C.R.

Binary system $NaPO_3$–$Na_4P_2O_7$. GEORGE W. MOREY AND EARL INGERSON. *Amer. Jour. Sci.*, **242** [1] 1–6 (1944). —In the binary system $NaPO_3$–$Na_4P_2O_7$ there is a eutectic at 552° and 0.31 weight fraction $Na_4P_2O_7$ at which the crystalline phases are $NaPO_3$ and $Na_5P_3O_{10}$, the only binary compound between the two end members. $Na_5P_3O_{10}$ melts incongruently at 622°, forming crystals of $Na_4P_2O_7$ and liquid containing 0.495 weight fraction $Na_4P_2O_7$. The optical properties of these three compounds are given. B.C.R.

Hydrothermal solubility of silica. GEORGE C. KENNEDY. *Econ. Geol.*, **39** [1] 25–36 (1944).—The solubility of silica glass in water has been determined through the range 200° to 420°C. at a pressure of 300 atm. The solubility is essentially 0 at temperatures below 200°C. and increases to a maximum of 0.20 part silica per 100 parts water at 360°C. Solubility falls off beyond 360°C. but is only slightly less at the critical temperature of water. Solubility in the vapor phase of water appears to be a function of the density of the vapor phase as well as of the temperature. At high pressures, as the density of the vapor phase approaches that of the liquid, its ability to act as a solvent will approach that of the liquid. B.C.R.

Symposium on color blindness: Foreword. DOROTHY NICKERSON. *Jour. Optical Soc. Amer.*, **33** [6] 293–94 (1943). **Facts of color blindness.** DEANE B. JUDD. *Ibid.*, pp. 294–307.—62 references. **Methodology in test preparation.** FORREST LEE DIMMICK. *Ibid.*, pp. 308–15. **Evolution of color-vision tests.** ELSIE MURRAY. *Ibid.*, pp. 316–34.—52 references. **Single judgment test for red-green discrimination.** LEGRAND H. HARDY. *Ibid.*, [9] 512–14.—3 references. **Farnsworth-Munsell 100-hue and dichotomous tests for color vision.** DEAN FARNSWORTH. *Ibid.*, [10] 568–78.—2 references.

Use of a strontium subfluoride band in the spectrochemical analysis of fluorine. L. H. ARHENS. *S. African Jour. Sci.*, **39**, 98–101 (1943).—A. continues his work on the determination of fluorine, using, instead of the CaF band, SrF bands for detecting fluorine. The most persistent band was the one with head at λ 5772 and was as sensitive as the CaF band test. This band is very clear and sharp and, as a result, is probably superior to the calcium subfluoride band. In the case of barium, the subfluoride band with head at λ 4992 was found to be the most sensitive. It was also persistent, but because of a considerable masking effect in the background, no definite sensitivity could be ascertained. On the quantitative side, the calcium subfluoride band with head at λ 5291 has been utilized by several workers. Several spectra show the variation in intensity of the calcium subfluoride band with change in fluorine content and the interesting variation for the strontium subfluoride band. These plates show that the strontium subfluoride band could be used equally well in quantitative analysis. Positives of the plates illustrate the paper. V.L.B.

BOOK

Colorimetric Determination of Traces of Metals. E. B. SANDELL. Interscience Publishers, Inc., New York, 1944. 487 pp., 73 figures, 66 tables. Price $7.00.—[Author's preface.] The colorimetric determination of traces of elements, especially of metals, has made great advances

in recent years. This book is not intended to be an encyclopedia of methods for the colorimetric determination of small amounts of metals. The aim has been rather to present a limited number of methods which at the present time appear to be best suited for dealing with traces of metals. No one reagent is necessarily the best for the determination of an element in all kinds of samples or under all conditions, and consequently two or three methods are sometimes described in greater or less detail for a number of the metals. A few fluorimetric methods are included. The treatment is to a considerable extent based on the experience of the writer in testing or using various methods. Anyone who surveys the methods of colorimetric trace analysis must experience a feeling of satisfaction arising from the many sensitive reactions available and, on the other hand, of something close to dismay at our imperfect knowledge of the application of these reactions. The effect of foreign elements on a particular color reaction is frequently poorly known, and the prevention of the interference of foreign substances has, for the most part, been incompletely studied. Methods for the separation of traces are but poorly developed or even nonexistent for many elements. The user of this book is likely to find many of his questions in this phase of trace analysis unanswered in the present treatment. It is to be hoped that the workers of the future will be willing to devote as much of their energies to this prosaic aspect of the subject as to the more inviting one of searching for new reagents.

PATENTS

Art of producing selenium. N. R. BIERLY (American Metal Co., Ltd.). U. S. 2,349,697, May 23, 1944 (Jan. 4, 1941).—The method of producing selenium which comprises adding acid to precipitate impurities such as tellurium from a solution containing selenium and the impurities until the resulting solution contains a slight excess of acid and has a pH above approximately 4 and less than 7, filtering the resulting solution, treating the filtrate at an elevated temperature with acid capable of precipitating tellurium and selenium as oxides, precipitating additional tellurium as oxide, and stopping the treatment with acid upon appearance of a red selenium precipitate.

Furfural purification. K. H. HACHMUTH (Phillips Petroleum Co.). U. S. 2,350,609, June 6, 1944 (Feb. 15, 1943).

Furfural purification method. C. K. BUELL AND C. M. COOPER (Phillips Petroleum Co.). U. S. 2,350,584, June 6, 1944 (Sept. 28, 1942).

Manufacture of antimony trioxide pigments. ERNST PODSCHUS AND GEORG MEDER (vested in the Alien Property Custodian). U. S. 2,350,638, June 6, 1944 (June 29, 1939).

Production and acid treatment of hydrous chromic oxide. MARC DARRIN (Mutual Chemical Co. of America). U. S. 2,350,960, June 6, 1944 (June 7, 1938; May 9, 1940).—(2) The improved method of reducing alkali chromate and of producing hydrous chromic oxide which comprises gradually adding a solution of an alkali chromate to a boiling alkaline emulsion of sulfur in a sodium sulfide solution and regulating the alkalinity to maintain it substantially uniform throughout the process. (4) The method of treating a hydrous chromic oxide resulting from the reduction of an alkali chromate with an aqueous alkaline emulsion of sulfur which includes the step of digesting the hydrous chromic oxide with a heated acid liquor, the pH of which, during digestive contact with the hydrous chromic oxide, is maintained between approximately 3 and 5.

Titanium oxide production. J. L. KEATS AND H. M. STARK (Canadian Industries, Ltd.). Can. 420,203, May 16, 1944 (July 5, 1940). G.M.H.

Zinc oxide. H. M. CYR (New Jersey Zinc Co.). U. S. 2,348,883, May 16, 1944 (June 3, 1940).

General

Acetylene torch and welding rod restore limekiln to service with minimum delay. ANON. *Pit & Quarry*, **35** [11] 93 (1944).—A step-by-step account of the rebuilding of part of a cast-steel tire on a limekiln in the plant of the Cutler-Magner Co. of Duluth, Minn., is given. 3 photographs, 1 sketch. M.R.

Aerial ropeway at nitrate plant. W. A. HARRIS. *Mech. Handling*, **31** [4] 150–54 (1944).—H. describes the materials-handling equipment installed in a plant of the Chilean Nitrate Co. in South America. 3 photographs, 4 diagrams. M.R.

Air sanitation. J. M. DALLAVALLE. *Heating & Ventilating*, **41** [5] 58–71 (1944).—While the discussion of air sanitation is limited to nonindustrial applications such as offices, auditoriums, galleries, department stores, and homes, data pertaining to industrial dusts which may enter these buildings are included. Such dusts include granite, gypsum, feldspar, lampblack, zinc oxide, resin, and grain dusts. The principles outlined apply to any kind of ventilation system, whether industrial or nonindustrial. 6 diagrams, 4 tables. See "Basic. . .," *Ceram. Abs.*, **20** [1] 34 (1941). M.R.

Aluminum therapy in the United States. J. W. G. HANNON. *Trans. Can. Inst. Mining & Met.*, **47**, 180–84 (1944).—It has been established that the inhalation of aluminum powder alleviates the symptoms of silicosis in a high percentage of cases and results in improvement in the worker's health, morale, productivity, etc. The rapid type of silicosis responds to treatment very well. Inhalation of aluminum powder prevents silicosis and is not harmful. Silicosis should be prevented by frequent examination of the workmen, adequate dust control, and the use of aluminum powder as a prophylactic. Already disabled workmen should inhale the powder. G.M.H.

Arc welding keeps equipment running. ANON. *Pit & Quarry*, **36** [11] 67 (1944).—Many applications of arc welding in repair and maintenance work at the plant of the Commonwealth Quarry Co., Summit, N. J., are discussed. 5 photographs. M.R.

Bituminous coal dust for molding purposes. F. ROLL. *Giesserei*, **29** [22] 371–74 (1942).—The addition of bituminous coal dust to molding sand is made to prevent a direct contact of the liquid or solidifying iron with the quartz grain and the binder of the molding sand; the amount of dust added is between 2 and 12% and should be such that a smooth, clean surface is obtained that requires little cleaning and additional material for machining. The properties of the coal dust should be carefully controlled and currently tested. It must contain less than 5% water, less than 10% ash, and less than 1.5% sulfur; the gas content should be at least 25% and, if possible, greater than 30%. The grain size should be, for general purposes, 15% max. total residue on 0.09-mesh and, for especially good surfaces, 10% max. The coal dust must not be adulterated by lignite, sand, coke, or charcoal, and should not be stored too long, as the gas content diminishes. The testing of coal dust for the different properties is described in detail. 21 references. M.HA.

Chemical processes in the drying of cores. F. ROLL AND A. RIESS. *Giesserei*, **29** [19] 320–26 (1942).—Binders used in a core are dried generally in three stages: (1) at about 20°, (2) at 20° to 120°, and (3) above 120°C. Drying depends to a large extent on the nature of the binder and the density of packing. For the loosest and densest packing of a core composed mainly of quartz sand with 3 to 6% viscous binder the following conditions exist:

Diameter of grains (mm.)	No. in 1 cc.	Surface (cm.²)	Thickness of binder layer on grain (mm.)	Space filling (%)
		Loosest packing		
0.5	8,000	62.80	0.009554	52.3
0.25	64,000	125.60	0.004777	52.3
0.10	1,000,000	314.00	0.0019108	52.3
0.05	8,000,000	628.00	0.0009554	52.3
0.025	64,000,000	1256.00	0.0004777	52.3
		Densest packing		
0.5	11,320	88.86	0.006752	74.05
0.25	90,558	177.72	0.0033761	74.05
0.10	1,414,900	444.30	0.0013504	74.05
0.05	11,319,000	888.60	0.0006752	74.05
0.025	90,558,000	1777.20	0.00033761	74.05

The chemical changes in the three stages are discussed for (*a*) linseed, wood, fish, and tall oil, (*b*) sulfite lye and molasses, (*c*) starch and dextrin, and (*d*) stearin and sulfate pitch. In general, mainly free humidity is removed up to 100°, but beginning at this and much higher temperatures (300° to 400°C.) chemically bound water is also removed to a great extent. Core properties, drying loss, strength, and color absorption are shown in curves. M.Ha.

Death floats in cadmium fumes. Anon. *Safety Eng.*, **87** [5] 57 (1944).—An account is given of five cases of acute cadmium poisoning brought about by heating cadmium-plated steel pipes. M.R.

Deionized water. W. S. Morrison. *Finish*, **1** [2 & 3] 14–17 (1944).—M. discusses the removal of calcium and magnesium ions from waters by the zeolite method. Resin zeolites are used in layers between pure quartz granules in the softener tank. Several installations of these water softeners are described. See *Bull. Amer. Ceram. Soc.*, **20** [7] 246–47, 250–51 (1941). W.R.B.

Engineering aspects of aluminum therapy. A. W. Jacob. *Trans. Can. Inst. Mining & Met.*, **47**, 185–202 (1944).—Aluminum prophylaxis should be administered every workday to those exposed to siliceous dust, preferably in the change house while the men prepare to go on shift. The treatment room should be airtight. Only aluminum powder approved by McIntyre Research, Ltd., should be used. One gram of powder per 1000 cu. ft. of room content is the basis for dispersal if the period of exposure is 10 min. This is halved if the time is doubled. Dispersal is accomplished by compressed air operated blowers, suitably located and blown in rotation, 1 min. for each can of powder. The compressed air used should be cleaned of moisture and oil. Discharge pressure should be 35 to 40 lb. per sq. in. and never less than 20 lb. The resultant suspensions will give an initial concentration of 30,000 to 35,000 particles per cc., decreasing 40 to 45% in 1 hr. due to dilution. Over 99.5% of the suspension will have a particulate size less than 5 μ. Over 90% will be 1 μ or less. The thermal precipitator is the only known instrument capable of accurate measurement of particle count and size characteristics of the suspensions. Konimetry cannot be employed. G.M.H.

Foreman's part in better labor relations. O. C. Cool. *Glass Ind.*, **25** [4] 166, 181, 185 (1944).—Foremanship is becoming a special craft demanding careful selection and training. It is a branch of management which provides the workers with (1) instructor, (2) director, (3) interpreter, and (4) friend. Top management should improve its handling of the foremen themselves. A.P.

Foundrymen's group approves code recommending ventilation practice. Anon. *Heating, Piping & Air Conditioning*, **16** [5] 293 (1944).—The Industrial Hygiene Codes Committee of the American Foundrymen's Assn. has developed a code of recommended practices for industrial housekeeping and sanitation which has been approved by the A.F.A. Board of Directors. Section 5 of the code applies to ventilation, and minimum air space requirements per person are prescribed as well as natural ventilation limitations. M.R.

Fused switchgear. R. T. Lythall. *Elec. Rev.*, **134** [3463] 481–84 (1944).—L. discusses switchgear protected by fuses and the circuits in which its use is advantageous. British designs are now capable of coping with 50 mv.-amp. 3 photographs, 2 diagrams. M.R.

Industrial ophthalmics. Anon. *Optician*, **107** [2765] 120 (1944).—In the provision of adequate lighting and seeing conditions in industry, the emphasis has recently been shifted from the provision of adequate conditions to the definition of optimum conditions. Good general brightness and the use of pale colors promote cheerfulness, efficiency, safety, and easy supervision and cleaning of machines. The brightness needed on the actual job rises more rapidly than the degree of "fineness" of the work. Special spectacles for constant close work will prevent much eyestrain and spoiled work. A time interval must elapse before the results of improved conditions can be felt. A.P.

Industry prepares for peace. K. G. Fuller. *Bull. Amer. Ceram. Soc.*, **23** [6] 211–12 (1944).

Installation of a sand preparation and distributing plant. J. J. Hall. *Mech. Handling*, **31** [4] 171–73 (1944).—H. describes the mechanical equipment used in preparing and distributing the sand in the foundry of Wright, Boag and Co., Ltd., Johannesburg, South Africa. 1 diagram. M.R.

Luminescence analysis of core oils and core binders. F. Roll and A. Riess. *Giesserei*, **29** [16] 269–73 (1942).—Luminescence (fluorescence) analysis offers the possibility of qualitative and quantitative analysis of core oils and binders. The source of ultraviolet light for such work must be fairly intense and perfectly free of visible light. A color list for some core binders is included.

Material	Fluorescence
Sulfite lye (granular), pine wood	Azure
Sulfite lye (granular), maple wood	Ocher (light)
Bituminous tar pitch	Black green
Yellow dextrin	Yellowish green
Potato starch	Blue-gray violet
Potato flakes	Luminescent white blue
Wheat bran	Blue violet
Clay	Brown

The apparatus and methods are described in full, and luminescence tables for viscous and liquid oils and solid binders are given which indicate the color in ordinary daylight and under the ultraviolet lamp. M.Ha.

National Joint Industrial Council for the Clay Industries. Anon. *Brit. Clayworker*, **52** [623] 152–54 (1944).—A detailed summary is given of the agreements reached covering the wages and conditions of employment in the clay industries in England and Wales. They include (1) scope, (2) hours of work, (3) standard minimum rates of wages, (4) good timekeeping bonus, (5) piece rates, (6) better conditions, (7) overtime rates and conditions, (8) night and split shifts, (9) essential work, and (10) holidays with pay. The agreement covering the employment of women in the building-brick and roofing-tile industries on work normally performed by males is given in an appendix. E.R.V.

Nature of the elutriation substances of natural molding sands. K. Endell, E. Wagner, J. Endell, and H. Lehmann. *Giesserei*, **29** [9] 145–53; [10] 170–73 (1942).—By photometering the X-ray interferences of quantitatively examined elutriation substances, the mineral structure, exchange capacity, and Enslin value as a measure for the swelling capacity were investigated. The elutriation substances contain an average of 60 to 80% clay minerals, predominantly of a mica type, besides kaolinite and rarely montmorillonite, 5 to 10% limonite (iron hydroxide gel), and always 5 to 20% of the finest quartz. The exhaustive investigations led to the following important conclusions for the casting technique. A very definite relation exists between the amount of replaceable bases

which are attached to the clay minerals only, and the green shearing strength. The quantity of the fluxing agents (iron oxide, earth alkalis, and alkalis), determined chemically in the elutriation substances, multiplied by the total quantity of the elutriation substances (relative sintering number) permits a prediction for the sinterability of the foundry sands at 1400°C. and thus for their suitability for certain types of castings. Three ranges of sinterability can be distinguished. At little sintering, no firing takes place, at medium sintering a pasty condition occurs, and strong sintering leads to a liquid phase between the sand grains which has a strongly cementing effect. Analysis and quantity of the elutriation substances can give important clues for the sand mixtures to be used to avoid burning of a molding sand for steel castings. From the amount of the wet elutriated molding sands smaller than 0.1 mm. which have been obtained by simple sieving, gas permeability in the green state can be predicted fairly accurately. Thirty-two references are included. M.HA.

Oil engines. E. INGHAM. *Cement, Lime & Gravel*, **18** [9] 245–48 (1944).—Practical hints on the care and maintenance of oil engines with respect to probable running troubles are given. E.R.V.

Progress in aluminum therapy. W. D. ROBSON. *Trans. Can. Inst. Mining & Met.*, **47**, 172–79 (1944).—The mining companies of Porcupine District established a clinic at Timmins, Ontario, to investigate the value of aluminum as a prophylactic in human silicotics. This clinic operated from 1939 to 1943. It was established that the use of powdered aluminum does ameliorate the symptoms of silicosis and that, as a prophylactic, it prevents silicosis and is itself harmless. There is no indication that the use of aluminum harms tuberculous individuals. Its use in silicosis therapy has been patented in most countries to prevent its being fitted into a commercial venture, to make it freely available to those threatened by silicosis, and to control further developments of the process. G.M.H.

Pulmonary disease in South Wales coal miners. Report of the Medical Research Council: Discussion and Summary. *Colliery Guardian*, **167**, 181–83 (1943). **Physical studies of the dust hazard.** T. BEDFORD AND C. G. WARNER. *Ibid.*, pp. 183–85.—A high correlation was found between the count of particles above 1 μ and the mass concentration of particles not exceeding 5 μ; there was a low correlation between the latter and total mass concentration. A thermal precipitator was used for sampling. Dust concentrations are much influenced by the nature of the operations being performed. A higher incidence of pneumoconiosis is associated with higher dust concentrations. **Mass concentrations of air-borne dust and mineral matter.** H. V. A. BRISCOE, P. F. HOLT, N. SPOOR, JANET W. MATTHEWS, AND PHYLLIS M. SANDERSON. *Ibid.*, p. 209.—A naphthalene filter was used. During the working of coal, the percentage of ash in the dust is less than during ripping. Pulmonary abnormalities are significantly correlated with ash content. **Air-borne dust composition.** G. NAGELSCHMIDT. *Ibid.*, pp. 209–10.—The coal was similar to that in the seams. Other minerals present were quartz, kaolin, mica, various carbonates, etc. The percentage of quartz in the dust varied from 0.1 to 4.7. **Petrology of coal measures, shales, and sandstones.** A. BRAMMALL AND JOHN G. C. LEECH. *Ibid.*, pp. 210–11.—In the anthracite mines, the shales are more compacted, and the content of secondary quartz and mica increases. The incidence of silicosis appears to be positively associated with the geological changes induced by pressure. **Chemical and X-ray analysis of the roof and clod.** D. HICKS AND G. NAGELSCHMIDT. *Ibid.*, p. 211.—The roofs and clod contained quartz, illite, kaolin, carbonates, and others. The quartz content varied from 8 to 46%. Quartz tends to be present in samples from mines with a high incidence of disease and vice versa. **Nitrous fumes from shot firing.** J. IVON GRAHAM AND D. F. RUNNICLES. *Ibid.*, pp. 211–13. See "Measurements. . .," *Ceram. Abs.*, **22** [5] 92 (1943). W.D.F.

Studies of exposure to dusts and fumes. ANON. *Heating & Ventilating*, **41** [5] 72 (1944).—The Industrial Hygiene Foundation has made studies, during the past year, on exposures to arsenic dust, lead dust and fumes, synthetic-resin dust, and other substances. M.R.

Symposium on industrial medicine: Introduction. C. D. SELBY. *Med. Clinics N. America*, **26** [4] 997 (July, 1942). **Physician in industry.** CARL M. PETERSON. *Ibid.*, pp. 999–1003. **Organization and management of an industrial medical service.** A. L. BROOKS. *Ibid.*, pp. 1005–18. **Physical examinations in industry.** GRANT L. BIRD. *Ibid.* pp. 1019–33. **Workmen's compensation and medicine.** RAYMOND HUSSEY. *Ibid.*, pp. 1035–51. **Tuberculosis as a compensation problem.** C. O. SAPPINGTON. *Ibid.*, pp. 1053–66. **Nutrition in industry.** W. A. SAWYER. *Ibid.*, pp. 1067–83. **Wartime survey of industrial psychiatry.** LYDIA G. GIBERSON. *Ibid.*, pp. 1085–1103. **Measurement of sickness among industrial workers.** W. M. GAFAFER. *Ibid.*, pp. 1105–20. **Fatigue and war production.** R. H. FLINN. *Ibid.*, pp. 1121–43. **Prevention of ill-health in industry.** J. H. FOULGER. *Ibid.*, pp. 1145–60. **Methods of appraisal and control of industrial health hazards.** J. J. BLOOMFIELD. *Ibid.*, pp. 1161–78. **Indoor environmental atmosphere and its control.** W. J. McCONNELL. *Ibid.*, pp. 1179–93. **Protective ointments and industrial cleansers.** LOUIS SCHWARTZ. *Ibid.*, pp. 1195–1212. **Effects of high pressures; Treatment of compressed air illness.** A. R. BEHNKE. *Ibid.*, pp. 1213–37. **Pneumoconioses.** L. U. GARDNER. *Ibid.*, pp. 1239–60.—G. includes among the pneumoconioses all chronic changes in the lungs induced by prolonged inhalation of dusts, irrespective of the type or the severity of tissue reaction. These changes vary from simple phagocytosis to progressive fibrosis. Silicosis and asbestosis are chiefly discussed. Under the term "simple benign pneumoconiosis," G. suggests the inclusion of uncomplicated anthracosis from coal dust and siderosis from iron dust. Although these dusts in a pure state have essentially the same effects upon the lungs as other forms of dust, they do not appreciably influence respiratory function. When mingled with quartz dust, a modified type of silicosis results. Attention is given to Roentgen findings, the part played by tuberculosis in silicosis cases, asbestosis and its relation to infection, clinical course, complications, and diagnosis. **Lead absorption and lead poisoning.** ROBERT A. KEHOE. *Ibid.*, pp. 1261–79. **Toxic properties of selected less familiar metals.** CAREY P. McCORD AND J. J. PRENDERGAST. *Ibid.*, pp. 1281–1302. **Recent progress in aviation medicine.** B. F. JONES. *Ibid.*, pp. 1303–30. Papers briefly abstracted in *Ind. Med.*, **11**, 395–96, 406 (July, 1942). K.R.

Synthetic foundry sands with cement as binders. K. ENDELL AND W. STRASSMANN. *Giesserei*, **29** [21] 349–56 (1942).—The influence of the amount of cement and water content on shearing strength and gas permeability of synthetic foundry sands was investigated with three German cement types: (1) normal Portland cement, (2) high-grade Portland cement, and (3) alumina cement. An optimum water content exists for every cement depending on the time the highest mechanical strength is required. Normally setting Portland cement needs only very little water to obtain its highest strength after setting 1 to 3 days, whereas high-grade cement and, especially, alumina cement require considerably more water for the same purposes. Ordinary Portland cement is unsatisfactory for foundry purposes as it has too little strength, at least for 10% additions; with higher additions, however, gas permeability is reduced too much. Alumina cement has the highest strength after 24 hr., but high-grade cement (Nova) reaches the same values after 72 hr., and its high initial mechanical strength is obtained with much less water. Also, it sinters at 1400°C., which is lower than the alumina cement with 40% alumina. The highest shearing strength in 10% Novo cement after 48 hr. was 7.5 kg. per cm.^{2} with 7% water content. M.HA.

George Westinghouse scholarship winners announced. ANON. *Bull. Amer. Ceram. Soc.*, **23** [6] 208 (1944).

THE BULLETIN SECTION

Volume 23 **July 15, 1944** **Number 7**

GEORGE F. YOUNG

GEORGE F. YOUNG

A Story of Roseville Pottery

The history of the Roseville Pottery must necessarily be a citation of the activities of George F. Young and his family. Many potters of note have been employed who have contributed to the reputation and success of this Pottery. They produced high-quality artware on a "mass-production" basis.

Mrs. Anna M. Young

The artists employed were "Chris" Nielsen, 1901–1905; Frederick H. Rhead, 1903–1908; John Herold, 1900–1906; Harry Rhead, 1908–1918; Frank L. D. Ferrel, 1918–; Frank Barks, 1920–; and George H. Krause, 1915–. These men possessed technical and practical potting knowledge. They could and did produce artware ranging from exquisitely decorated individual pieces (each selling at the highest of market prices in the most discriminating market) and mass-produced jardinieres for the china-store trade to A & P premium vases at $10 a gross. George Krause and his associates, Ferrel and Barks, are continuing such original developments.

This ware met fully the demands of this widely diversified market. It had the quality that is required to sustain market demands. But there was behind this ware the rare business acumen possessed by George F. and Anna M. Young.

In the 1890 depression years, George Young was sales representative for a small stoneware shop in the town of Roseville, Ohio. His wife, Anna, had a millinery shop stocked with her own creations. Those were in the pre-trolley and pre-automobile days when townsfolk rarely traveled "to the city" to make personal purchases. She had a home market, but so did others, but no one satisfied the millinery wants in the Roseville district as satisfactorily and at prices so moderate that the wives of farmers and shopmen could have millinery as smart in style and fine in quality as that procurable in the best of city shops. Anna M. Young built a business of her own on high-quality, low-cost merchandise. In her youth, she was a smart merchandiser.

But the depression closed down the pottery and slowed to a trickle the millinery business. Something had to be done if they and their two babies were to survive the depression. It was Anna who prompted her husband to buy the little pottery and make ware that could be sold in the depression market. That was the start of A & P premiums.

George H. Krause

Anna M. Young was creative in very practical ways. She foresaw market changes. She had unusual business ability, as shown by the forthright manner in which she managed the production and sales after the passing of her husband and son. George F. Young was a business executive of daring resourcefulness. He dared to make ware for all sorts of markets. From a small investment of his savings, plus confidence of bankers in his integrity and ability, he soon expanded from the small stoneware plant

in Roseville to the much larger plant in Zanesville. His wife's premium ware soon crowded out the utilitarian stoneware and, starting with them, he soon was making artware comparable to the best. He reinvested profits in plant modernization, but always conservatively, until his plants were equipped to produce at the lowest cost. He was the first art pottery producer to install a tunnel kiln, and a brave venture it was to invest in one of forty-car capacity.

At different times they owned and operated four different potteries, (1) the Roseville Pottery, Roseville, 1890–1905; (2) the Midland Pottery, Roseville, 1895–1907; (3) the Roseville Pottery Putnam Plant, 1901–1917; and (4) the Roseville Pottery Plant, Zanesville, 1898–. In 1931, the company was incorporated as Roseville Pottery, Incorporated.

In the Midland plant, they developed a line of stoneware utilitarian ware in a variety of colors: blues, greens, tans, and browns. They were the first to have a white opaque glossy Bristol glaze. They experimented on a line of stoneware specialties, such as jugs for whiskey, syrups, inks, etc., in a variety of designs and colors, and garden ware. These, however, they did not market. They did market stoneware crocks, jugs, bowls, and pitchers in a variety of colors.

As a teammate for Chris Nielsen and Fred Rhead, who were devising new ware, new processes, and new decorating styles, they had a supervisor, John Herold, a ceramic artist of practical ability and excellent managerial and versatile ceramic ability. John Herold could put into mass production the art creations of Nielsen and Rhead and initiate with them many ideas of his own. When George Young wanted a line of oxblood copper-red vases such as those made famous by the Chinese, John Herold built the kiln, devised the copper glaze, and produced oxblood vases at a low cost, and this without much experimentation. This venture was successful from the start.

With Frank Ferrel, Frank Barks, and George Krause, the Roseville Pottery, Incorporated, is carrying on with the high-grade artware production made famous in the earlier years by Nielsen, the Rheads, and Herold.

George H. Krause

George H. Krause was born in the potters' town of Bunzlau, Germany, and grew up in a window glass and refractories plant which his grandfather founded in 1872. With his father he developed and used successfully a periodic kiln firing large refractory shapes to cone 20 and higher, using exclusively the semiliquid tar formed as a by-product in the gasification of lignite for the glass plant.

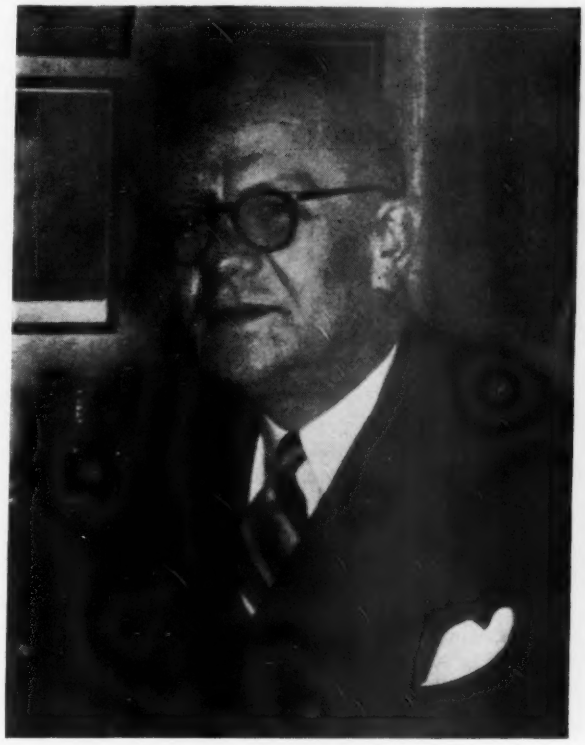
George studied ceramics under Professor Doctor W. Pukall, who was an associate of the founder of all modern ceramics, Professor Hermann A. Seger. After this, George spent two years in Berlin and one year in Dresden in development work in the faience and art pottery field.

He came to the United States in 1913 to study American methods and to improve his knowledge of English. In the meantime, World War I had started and changed his original plans to return home after two years. His first job in the United States was with the New Jersey Terra Cotta Company in Perth Amboy, New Jersey. He later moved to Zanesville where he worked for the David Shmidt Art Pottery. In 1915, he became associated with the Roseville Pottery in Zanesville, and since 1917 he has been in charge of all technical developments and production at this plant. In 1936, he was elected Vice-President, which position he still holds.

George F. Young retired as President and General Manager in 1918 and died in 1920. His son, Russel T. Young, was made President and General Manager in 1918 and served as such until 1931. Russel died in 1934. Anna M. Young served as President and General Manager from 1931 until 1937. She died in 1939. Their son-in-law, Fenwick S. Clement, succeeded Mrs. Young and directed the corporation during the years 1937 to 1944. He died March 28, 1944. Mr. Clement was succeeded by his son-in-law, Robert P. Windisch.

Fenwick S. Clement

Mr. Clement was a native of Dunham, Quebec. The family moved to Boston, Massachusetts, in his infancy, and he was reared and educated there, graduating from the Boston Latin school, oldest educational institution in the United States.



Fenwick Scott Clement

He resided in Boston for thirty-five years and for fifteen years was connected with the wholesale grocery firm of Bain Brothers. During this time, he traveled extensively throughout the New England states.

On February 24, 1910, he was married to Miss Leota Francis Young. He went to Zanesville in 1919 as Sales Manager for the Pottery and was made Secretary of the Company in the same year.

In 1928, he established an automobile sales agency, operating it for seven years, during which time he was for several terms president of the Zanesville Automobile Deal-

ers' Association and sponsored several automobile shows at the old Palace Garden.

He left the automobile business to devote his full time to the pottery industry, and in 1937 was named President of the Company, retaining his post as Sales Manager.

Robert P. Windisch

Robert P. Windisch

Mr. Windisch joined the Company three years ago as Sales Manager and Manager of Real Estate.

A former oil man, he went to Zanesville in 1932 as District Manager of the Benedum-Trees Oil Company and the Penn-Ohio Oil Company. The district included Ohio, Pennsylvania, West Virginia, and Kentucky.

Born at Marietta, Ohio, Mr. Windisch resided for some time in Columbus before moving to Zanesville.

Mr. Windisch's wife, Georganna Clement, is the daughter of the late Fenwick S. Clement.

DESIGNER AND TECHNOLOGIST SHARE COMMON INTEREST*

By Vincent Broomhall

I. Introduction

There are two kinds of production, hand production and machine production. The first type of production is termed "handicrafts," for the worker is a craftsman. He designs his tools suitable for the needs of his material and becomes their master, for he knows the exact duties they must perform. For the most part, the craftsman is an artist at his work.

The second type of production is termed "industry"; the worker is the operator. The machine-made product should catch the same meaning as the product made by the hand of the craftsman. The manufacture of dinnerware lies somewhere between these two types, for we are still far from being entirely mechanized and are certainly a long way from hand production.

In the past twenty years or more, we have traveled far on the road to becoming mechanized; we have left the handicraft stage.

With the advent of labor-saving equipment and power machinery came the possibility of doing the same work, not only in greater multiples and faster, but also better. It is on this foundation that mass production is based.

II. The Machine in the Dinnerware Industry

The dinnerware industry is divided into two groups.

The first group manufactures dinnerware of the highest quality, beauty, and craftsmanship. It can adopt some degree of mechanization, but will still retain the hand of the craftsman owing to the variation and aesthetic quality of the product.

The second group can adopt almost complete mechanization, because it will manufacture in larger quantities and in a more limited range. The standards of quality, however, must not be lowered. Dinnerware must still remain a product of quality in design, glaze, and decoration.

In many cases, a much better product has been manufactured by the employment of machinery. For example, why should we continue to use the old method of hand glazing when modern spray equipment does a better job? To date, we have such modern equipment as tunnel kilns, automatic jiggers, spray machines, and conveyer systems.

This is only the beginning, for we now hear of automatic lining machines and many other postwar ideas that will make this industry highly mechanized. What does this mean to the designer, the engineer, and the scientist? It means that the coordination of their abilities is more necessary today than ever before.

Some persons feel that if machinery plays too important a part in the manufacture of pottery we will become too restricted and lose many of the fine qualities of pottery making. To the designer, it means only that he must design better. His designs become more practical because they are more thoroughly thought out. He designs with the knowledge of how the machine functions and works accordingly. Naturally, the machine will never replace the fine art of pottery making, but commercially it will go far, for it will effect a great economy in manufacturing. This economy in turn will mean that many persons who a few years ago could afford to purchase only plain white ware can now buy decorated ware for the same amount of money.

Merely buying and installing machines, however, is not planned mechanization. It is much more than that. It also means taking into consideration plant layout, working conditions, organization and management, and allowing for future developments.

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944 (Design and White Wares Divisions). Received April 5, 1944.

III. Designing for Mass Production

In designing for mass production, the designer must strive for a high sales average, for he is serving a broader field and is designing for 30 million potential customers. He must think, therefore, in terms of the average customer who makes up the buying structure of the nation. In serving this popular-priced market and designing for mass production, the designer must have a thorough knowledge of the use of his product, a scientific knowledge in creating his product, and an aesthetic feeling toward his product. All this he must do within certain limitations. His designs must be practical, not only from a manufacturing viewpoint, but for their utilitarian value and their appeal to the public.

IV. Work of the Engineer

Also, with the advent of machine production in dinnerware, came the engineer. It is just as important for the engineer to have a thorough knowledge of his materials, their possibilities and limitations, as the designer, for as the craftsman develops his hand tools to meet their useful purpose, so must the engineer develop machinery with the same knowing purpose. He must develop the machinery with a thorough understanding of purpose, materials, tools, and process. To a certain degree, this machinery must be flexible to allow for such variation as the designer may need for creating and styling his product. For that reason, it becomes most necessary that the designer and engineer work hand in hand in these developments, for they share a common interest in machine production.

V. Future of the Dinnerware Industry

Although development work in the dinnerware industry has progressed greatly, there is still much ground to cover. The future of the industry should be of great concern. It concerns not only the dinnerware industry, but the entire ceramic field.

Other industries have made great progress. We have seen many great miracles of the machine age.

We have seen the farm develop from a few fields cultivated by the horse and plow to vast acres where huge machines not only plant the crop, but also cultivate and harvest it.

We have seen cloth made from glass, stockings made from coal, rubber made from oil, and many other remarkable developments of progress. We are living in an age of experiment where great advancements are being made in every industry.

The ceramic industry must get on the offensive side. We cannot afford to be on the defensive, for we never know what the scientists in other fields might develop to replace our products. In the past few years, we have heard much about plastics. The development of plastics has gone far, and we are now hearing of plastic dinnerware. Plastics will not seriously affect the pottery industry, for ceramics has much greater decorative possibilities. It should give us enough concern, however, to stimulate us to encourage more research in the ceramic field. The entire ceramic industry should exert every possible effort to find new fields for its products.

At the present time, the dinnerware industry is riding on the crest of a wave. Today the chief concern is production. For the past few years, the American potters have had the entire American market to themselves. It is too much to hope to retain this full market, for when we again return to normal living, foreign dinnerware factories will be eager to pounce on the American market at the earliest opportunity. We should be planning now to retain as much of this market for ourselves as possible. We should make the greatest possible use of artistic, scientific, and technical developments to keep our place in industry.

Our foreign competitors have certain advantages. Import duties have always been in their favor, and foreign labor has always been much cheaper than American labor. These two advantages, together with the fact that they have always made a good product, have made our problem a serious one. The most obvious approach to helping this situation is to develop more mechanization and gain simplified production. This will help to counteract the labor condition. By technical research, however, we can hope for faster firing periods in our kilns and possibly many other developments. By such advancements, we can compete with foreign factories.

In the course of such development, we must not overlook the fact that as Americans we have no priority on future developments. Foreign factories will also be advancing. It therefore is all the more important that we retain the leadership in mechanization.

The American dinnerware industry undoubtedly has advanced more mechanically than the foreign factories, but we must realize that they are thinking along these lines.

Before the war and even in the early part of the war, British pottery companies were sending representatives to visit our factories to determine the extent of our mechanical progress. Their ceramic journals indicate how seriously they are viewing mechanized production.

We should exert every possible means to promote American ceramics to fix it in the minds of the American public. Let us tell them that this is an American product and that American ceramic has gained great prominence, even though we have been manufacturing for no more than one hundred years. The American ceramic industry needs much more publicity in the future than it has had in the past, and we should take it upon ourselves to cause such publicity. It might be worth suggesting to The Society that we form a committee to encourage publicity. Such a committee may find an answer. At least such a committee could go far in securing the help of national publications in telling the public the story of American ceramics. The romance of pottery in itself would make an interesting article for any national publication.*

The glass manufacturers have done a much more commendable job in this respect than the potteries, for their competitive problem too has been a great one. Many glass manufacturers have done a grand publicity job. We can scarcely pick up any one of our monthly magazines without seeing their ware.

There is much to be done in the ceramic field, and each member of the industry is a part of what can be done. Let us hope that the future holds much in store for us, but always remember that we must make that future.

EDWIN M. KNOWLES CHINA COMPANY
EAST LIVERPOOL, OHIO

* Such a committee has now been formed. See *Bull. Amer. Ceram. Soc.*, **23** [6] 207 (1944).

PRESIDENT'S EDITORIAL

OUR DIVISION PROGRAMS

By E. H. Fritz, *President*

The programs of papers and discussions which our Divisions have presented at the Annual and Autumn Meetings have been consistently excellent and of high order. They have covered a broad scope of subjects, have added much to our ceramic literature, and thus have been and will continue to be of immeasurable value to our membership. This standard has been maintained during the recent war years, and this is particularly gratifying when we consider the stress of the times, the shortage of manpower, and the great demands upon the time of those who are carrying on in the industry. If this were not so, we would not have had the record attendances at the recent Pittsburgh Meeting and the Autumn Meetings that were held last year, for we must remember that the caliber of the program which is announced for a particular Meeting determines more than anything else the attendance at that Meeting. The contact with fellow members is, of course, an important factor also, but the fact remains that a large percentage of our members will scan the program when a Meeting is announced and, depending upon the interest aroused by it, determine whether or not they will attend.

And yet, although this high standard of our Division programs has been maintained, we should not be satisfied to let the matter rest there. There are several ways in which it could be raised further and broadened, with a resulting increase in the interest and activity of our members:

(1) A more intensive effort should be made to induce a larger percentage of our members to take part in the programs. We have hundreds of members whose names never appear on any program. Many of them can give no valid excuse for this. The nature of their work, their knowledge, and their ability to write and present a paper are such that they could offer an excellent paper, in many cases on subjects on which little or nothing has been published. It is strange indeed that this condition exists. The excuse which is often given, that their employers will not permit them to write papers, is actually not an important factor because in these days the number of such employers is few and many of those who impose restrictions are quite willing to permit papers on certain phases of their activities. In many cases where such a policy exists, it might be modified if the executives of each company were properly approached by our Division officers. This, however, is not the heart of the situation.

I have talked to many of these men who could write papers, and I cannot help but conclude that, in most cases, it is simply a matter of insufficient energy and industry to get the job done. In other words, they follow the path of least resistance and direct their attention to activities that seem more attractive and pleasant. It is a serious mistake. These men could greatly improve and broaden themselves by presenting papers because it would give them a better conception of their own work, and any discussion of the paper that develops will often provide new viewpoints and avenues for further work and accomplishment. There is also the important factor of becoming better known in The Society and building prestige. The value of this is tremendous and needs no further elaboration. If these men will just give some serious consideration to these matters and realize their importance, their inertia will be overcome and they will do something about it. Those of us who appreciate this should therefore keep after these members and make use of every opportunity to persuade them to write papers. A concerted effort unquestionably will accomplish something.

(2) Our programs should be better balanced. We need more papers and discussions of direct interest to our operating men. In practically all Divisions, the highly technical type of paper predominates. The solution to this, to some extent, depends upon getting more of our members to write papers, because it is the operating men who are the greatest offenders. This problem, however, can also be solved by holding more round-table discussions and symposia on subjects of general interest. This provides an easier medium to induce members to appear on a program, because many who cannot be persuaded to write a paper will present data in a round-table discussion. Papers and discussions of this kind have a tremendous value as they are more apt to develop further extemporaneous discussion on the floor because the nature of the subject makes it possible to develop quick reactions and ideas, whereas a highly technical paper requires time for assimilation and reactions and those present are not immediately prepared to discuss such a paper. Discussions on the floor often bring out facts of great value which otherwise would never become available, and it is because of this that many of our members consider them the most valuable part of our Meetings.

It is essential, therefore, that such papers and discussions form a larger and regular part of our Annual Meeting programs. Further, every Division should hold an Autumn Meeting each year with a program largely of the same type. Such a policy put into practice will not only increase the interest and attendance of our present membership, but we will gradually get more and more members to take part in the discussions and eventually write papers. We also will attract new members into The Society and thus widen the scope and service of The Society and accomplish our goal to "Double the Membership." Every one of us can help in this. Will you do your part?

AUTUMN MEETINGS

Glass Division: Hotel Schenley and Longue Vue Country Club, Pittsburgh, Pa., September 13 and 14.

White Wares and Materials and Equipment Divisions: Hotel Summit, Uniontown, Pa., September 15 and 16.

SHIRKING Organization Dues and Duties
Is Attempting to Take the Head
Without the Body Which Nourishes It

✦ ✦ ✦

Joining Organizations
Without Feeling Responsibility of Participation
In Their Activities
Is Grasping the Form and Losing the Substance

✦ ✦ ✦

Full Professional Life Cannot Be Achieved in Isolation
Common Possession of Knowledge and Art
Is a Distinguishing Attribute of an Industrial Group
Devoted to Its Common Advancement
Rather than Maintenance of Economic Monopoly

✦ ✦ ✦

ORGANIZATION Dues and Duties Are Essential
Means of Enriching One's Professional Lifeblood

PROMPTED BY ADDRESS OF DR. WILLIAM E. WICKENDEN "THE SECOND MILE"

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
June 21, 1943	1950	283	14	441	220	2908
January 21, 1944	2110	323	4	531	220	3188
February 21, 1944	2147	330	4	540	220	3241
March 21, 1944	1844	323	4	523	220	2914
April 21, 1944	1996	344	3	560	220	3123
May 21, 1944	2061	361	4	570	220	3216
June 21, 1944	2125	366	3	576	220	3290

NEW MEMBERS IN JUNE

Corporation

PITTSBURGH PLATE GLASS CO., COLUMBIA CHEMICAL DIVISION, R. W. Miller (voter), Barberton, Ohio.

Personal

*BARKBY, HARRY, 217 Hillcrest Ave., New Castle, Pa.; art director, Shenango Pottery Co.

BICKFORD, FRED A., 75 E. Second St., Corning, N. Y.; research chemist, Corning Glass Works.

BOSSARD, ALBERT G., 9 Houghton Circle, Corning, N. Y.; Corning Glass Works.

BRONSON, JAMES G., Westvaco Chlorine Products Corp., Chrysler Bldg., New York, N. Y.; chemical producer.

BROWN, JOSEPH A., 3601 E. Monument St., Baltimore 5, Md.; president, Baltimore Brick Co.

CHILDS, ROBERT L., 89 E. First St., Corning, N. Y.; Corning Glass Works.

CLARK, ORRIN H., Corning Glass Works, Corning, N. Y.; physicist.

CLEGHON, CHARLES C., 535 George St., Clyde, Ohio; Clyde Porcelain Steel Corp.

CROSS, OWEN H., 319 East 4th St., Alton, Ill.; Owens-Illinois Glass Co.

DIRLAM, ARTHUR C., 218 Decatur St., Corning, N. Y.; Corning Glass Works.

DRAKER, HARRY C., 13614 Fourth Ave., East Cleveland, Ohio; Harshaw Chemical Co.

ELLIS, RICHARD B., 168 Cedar St., Corning, N. Y.; Corning Glass Works.

ELLIS, WILSON H., Ceramic Dept., R. T. Vanderbilt Co., Inc., East Norwalk, Conn.; ceramic engineer.

FARNCOMB, FREDERICK J., 180 Princeton Ave., Corning, N. Y.; Corning Glass Works.

FENNER, ALICE C., Cranston Fenner Studio, New Preston, Conn.; designer-sculptor.

FINCH, KATHERINE S., 121 Coast Highway, Corona Del Mar, Calif.; designer and partner, Kay Finch Ceramics.

GIBSON, KENNETH A., 29 Jennings St., Corning, N. Y.; Corning Glass Works.

GIRARD, T. R., Works Lab., General Electric Co., Schenectady, N. Y.

GOLDSMITH, JULIAN R., 164 Pine St., Corning, N. Y.; Corning Glass Works.

HALEY, KENNETH R., 636 Fairmont St., Greensburg, Pa.; development engineer, Jeannette Shade & Novelty Co.

HATCH, ROBERT A., Corning Glass Works, Corning, N. Y.; research chemist.

JACOBSON, ALBERT, 29 West 8th St., New York 11, N. Y.; potter and ceramic sculptor.

KING, CHARLES B., 127 E. First St., Corning, N. Y.; Corning Glass Works.

KRAMPF, FRANCIS G., 145 Walnut St., Corning, N. Y.; Corning Glass Works.

MILLER, FRANK K., 92 E. First St., Corning, N. Y.; Corning Glass Works.

MOCHEL, JOHN M., 209 E. First St., Corning, N. Y.; Corning Glass Works.

MORRIS, JOHN L., A.P.O. 487, c/o Postmaster, New York, N. Y.; Commercial Decal, Inc.

PAQUETTE, CYRIL T., 315 W. Pulteney St., Corning, N. Y.; Corning Glass Works.

PARKER, CHARLES J., Corning Glass Works, Corning, N. Y.

PETTS, OMER F., 2713 Ashland Ave., Baltimore, Md.; superintendent, Baltimore Brick Co.

PICKARD, HENRY A., Corona Ave., Antioch, Ill.; president, Pickard, Inc.

SHELDON, JOHN L., 112 E. Third St., Corning, N. Y.; Corning Glass Works.

SMITH, GAIL P., Box 158A, Route 1, Corning, N. Y.; Corning Glass Works.

*STONG, GUY E., Strathmont Park, Elmira, N. Y.; Corning Glass Works.

*STOOKEY, STANLEY D., 145 Pritchard Ave., Corning N. Y.; chemist, Corning Glass Works.

TOROK, JULIUS J., 134 East 4th St., Corning, N. Y.; Corning Glass Works.

VOGT, HAROLD G., Main Plant Lab., Corning Glass Works, Corning, N. Y.

WEBB, HERBERT, Coalbournhill Glass Works, Stourbridge, Worcestershire, England; managing director.

WERNER, ALAN J., 159 East 4th St., Corning, N. Y.; research laboratory, Corning Glass Works.

WIKER, RICHARD M., 315 W. Pulteney St., Corning, N. Y.; Corning Glass Works.

WILLEMS, H. W. V., 215 Cedar St., Corning, N. Y.; Corning Glass Works.

WILSON, RICHMOND W., 142 Pine St., Corning, N. Y.; Corning Glass Works.

*ZIMMER, MAJOR WARREN A., 0-337660, A.P.O. 98, c/o Postmaster, San Francisco, Calif.; Joseph Dixon Crucible Co., Jersey City, N. J.

Student

Missouri School of Mines: WILLIAM J. SMOTHERS AND KENNETH M. WILHELMS.

New York State College of Ceramics: RICHARD FAULKNER AND CHARLES H. TAYLOR, JR.

University of Washington: *JOHN H. HENDERSON.

MEMBERSHIP WORKERS' RECORD

CORPORATION: R. R. Shively 1.

PERSONAL: W. H. Armistead 2, W. H. Armistead and J. T. Littleton 1, G. J. Bair 1, H. F. Bopp 1, H. D. Carter 1, E. W. Emrich 1, W. L. Fabianic 1, K. B. Faulkner 1, J. V. Fitzgerald 1, W. J. Harr 1, H. P. Hood 1, Theodore Lenchner 5, J. T. Littleton 6, G. V. McCauley 1, E. P. McNamara 1, J. G. Mohr 1, M. E. Nordberg 1, W. W. Oakley 1, W. W. Oakley and W. C. Taylor 1, R. Russell, Jr. 1, R. K. Smith 1, W. C. Taylor 6, L. E. Thiess 1, W. E. S. Turner 1, W. A. Weldon 3, Office 1.

STUDENT: R. M. Campbell 1, P. G. Herold 2, H. H. Nakamura 1, K. G. Skinner 1.

GRAND TOTAL: 49.

ROSTER CHANGES FOR JUNE†

BRETZ, LEWIS A., 3332 N. Industry Road, R. D. 5, Canton, Ohio (Barberton, Ohio)

CORDES, JOHN E., White Hall, Ill. (Milwaukee, Wis.).

DIETRICH, WOLDEMAR F., 512 Baughman St., Claremont, Calif. (Fontana, Calif.)

EGGLESTON, MYRON M., Alamo Pottery, Inc., 2150 Frio City Road, San Antonio 7, Texas (Perrysville, Ohio)

FISHER, HELEN, 36 N. Walcott St., Salt Lake City, Utah (Metuchen, N. J.)

HELZ, ARMIN W., Gaithersburg, Md. (Silver Spring, Md.)

HOSSENLOPP, ARTHUR M., 28 Kendall Ave., Maplewood, N. J. (Metuchen, N. J.)

HUBLER, WILLIAM G., Nepheline Products, Ltd., Lakefield, Ontario, Canada (Philadelphia, Pa.)

MCCANN, F. A., Route 3, Box 907, Stockton, Calif. (Los Angeles, Calif.)

SMITH, WALTER T., 30 Austin St., New Haven 15, Conn. (Gordon, Ga.)

STUCKEY, ROBERT C., JR., Box 152, Manasquan, N. J. (Belmar, N. J.)

TODD, EDWIN R., 2143 Norton Road, Charlotte, N. C. (Chicago, Ill.)

WHITTEMORE, O. J., JR., Room 4-049, Massachusetts Institute of Technology, Cambridge 39, Mass. (Pittsburgh, Pa.)

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* Indicates former member of The Society rejoining.

† Address in parentheses is former address.

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(279) VERLE CAMPBELL, New York State College of Ceramics, Alfred, N. Y.
(280) JOHN L. MORRIS, Commercial Decal, Inc., East Liverpool, Ohio.
(281) W. D. PACKMAN, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
(282) JOHN T. PITTENGER, Homer Laughlin China Co., Newell, W. Va.
(283) JOE STEVENS, Emsco Refractories Co., South Gate, Calif.
(284) WARREN A. ZIMMER, Joseph Dixon Crucible Co., Jersey City, N. J.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

EDITORIAL

THE CERAMIC ENGINEER IN PORCELAIN ENAMELING PLANTS*

BY C. S. PEARCE

The extensive use of ceramic engineers in porcelain enameling plants seems to be definitely assured after the war.

The Number One job of American industry today is the study of methods to secure adequate employment of the nation's working force in postwar years. This problem transcends even the requirements for war production. It will engage the best thinking of management groups for a long time after the war is over.

For the purpose of better studying the position of the ceramic engineer in this field, it seems advisable to cover the years from 1923 to 1953 only. These break down into three fairly definite periods.

From 1923 to 1933 was a time when unemployment was the key thought of every industrial executive. Not unemployment as it is viewed today, as a group of men standing unable to find work, but rather as the effort on the part of management to unemploy men through process improvements, labor-saving machinery, and other technical developments. The entire urge of manufacturing organizations in this period was one of cost cutting. It was the heyday of time study and efficiency engineers. Everyone was seeking to reduce costs, and in the end unemployment reached the disastrous figures of 1933.

From 1933 to 1943 was a period of re-employment. First, this problem was attacked slowly, when men were put back to work with a maximum of reluctance on the part of management to add to total payrolls. Later, it became a rush to man plants properly with as good a labor force as could be obtained. Finally, it approached labor hoarding irrespective of expense just to be sure that the proper man would be at the proper place when necessary.

From 1943 to 1953 will be a time of total employment. The urge during this decade will be not to hire and fire as in the two previous decades but to maintain employment levels at a constantly fixed high figure. It seems to those who observed the opening of this period carefully that profit-making has taken a second place to the problem of providing total employment. Perhaps a new driving force has been introduced to private enterprise—something different from the profit-making urge. In places it seems to have become equivalent to a religious concept. Some leaders feel that the maintenance of total employment is the only way that our present civilization can be preserved. Perhaps we are witnessing the introduction to modern industry of a force as strong as that which has kept Christianity alive for two thousand years.

Where does the porcelain enamel industry fit in this picture?

The decade from 1923 to 1933 was one of almost uninterrupted growth. This was the time when practically every branch of the porcelain enameling industry was improving in volume each year. Even in 1933 porcelain enameling plants showed a much smaller shrinkage in volume than many other large-scale industries.

From 1933 to 1943 was a period of relative stabilization. There was no fantastic new application of porcelain enamel which showed the growth that the refrigerator, stove, and washing-machine industries had shown in the previous decade. True, these older items did show remarkable increase during that period, but this increase in production was cancelled by 1942 and 1943. From 1943 to 1953 appears to be another decade of rapid growth. This period will be marked first by the return of all the normal porcelain enamel products to production, supported by a huge backlog of unfilled demands from domestic consumers. On top of this backlog will be imposed the production of new items both in the fields which have already been proved and in manufacture which is still undeveloped.

Probably this growth will be accomplished in the fol-

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944 (Enamel Division). Received April 5, 1944.

lowing manner. The present standard items, such as stoves, refrigerators, washing machines, and plumbing ware, will increase in volume largely due to the backlog and the normal growth of the country. No spectacular new use will develop in any of these fields. As shown, however, by the market study of the Porcelain Enamel Institute Market Research Committee, the volume in these fields will be large. Perhaps a total of 69 million units in the three appliance items will be built in the six or seven years immediately following the war.

The next large volume of business will undoubtedly come from those items which have been proved and on which some commercial development has already been done. This includes range boilers, formed metal plumbing ware, filling stations, and, oddly enough, advertising signs. These items will contribute more than the normally expected volume for the industry.

Imposed on top of this production will be still a third group which is potentially large and upon which a small amount of commercial development has already been started. These include general building usage, or so-called architectural work; roofing, i.e., corrugated roofing; and industrial applications which, although small, have been spectacular.

Finally, on top of the whole will be the volume of work which will develop from the new products upon which neither the engineering work nor commercial development has been done. In this group would come signs for superhighways, an item upon which very little work has been done, largely because we have had few superhighways; dish washers, largely because we have had no satisfactory domestic dishwashers to date; and frozen-food storage, largely because this entire new branch of the food-handling industry is in its infancy.

To this may also be added some new items which will develop as entirely new usages which have not yet been envisaged.

That is the industry. Paralleling this history has been the progress of ceramic engineers in porcelain enameling. In 1923, it was probably possible to count the ceramic engineers in porcelain enameling plants on one hand, certainly on two. They were pioneers, mature men who were attempting to bring to this industry some knowledge of the technical phases of the work, and junior engineers recently graduated from ceramic colleges.

By 1933, the industry was accepting these men to a great degree in research and other laboratory connections and to a limited capacity in shop operation. By 1943, some of these men had been promoted to executive capacity largely in the supplying branch of the industry. In casting about for a man to head an important committee of the Porcelain Enamel Institute last year it was discovered that only one ceramic engineer had been elevated to an executive position in a porcelain enameling company as distinguished from a supplying company. This condition will change materially in the postwar years.

There must be considerable revision, however, in the thinking that is necessary. Ceramic graduates and ceramic engineers must give more attention to operating problems and less attention to experimental work, i.e., more interest will have to be displayed in the application of porcelain enamel to the finished products and, by the same token, considerably less interest by the individuals in the manufacture of materials. There undoubtedly will be more interest shown in the executive problems and less in the technical problems. Although the ceramic engineer will still be expected to know the fundamentals underlying the chemistry of normal application, he will find it necessary to know much more about accounting and labor problems.

To open this extensive field will require the acceptance of the ceramic engineer by three divergent groups. First, he must be accepted as a member of a recognized branch of the engineering profession. This was not true until recent years. Much as the metallurgical engineer was subordinated to the mechanical and the chemical, so the ceramic engineer had been subordinated to the chemical. At least, it was considered to be a branch of chemical engineering. Today the engineering profession has accepted ceramic engineers on a par with the four older branches of engineering. To make this example more specific, it might be noted that industrial engineering or management engineering still have not been accepted in the professional groups.

To assure the more extensive use of ceramic engineers in porcelain enameling plants, they must be recognized by the workers in such plants as competent professional men. This change is in progress and undoubtedly will follow the history of electricity, where the electrical engineer is now the recognized leader in that field, or the field of machine design, where the mechanical engineer now has his proper place. This recognition of the trained man by the operators of any plant will make the services of the ceramic engineer far more valuable for controlling processes, methods, and quality.

With recognition coming from both the other engineering groups and the workers, managements may also recognize the important advantage of ceramic engineers in executive positions. Once management has taken notice of men in this field, it will not be long before engineers will break into the activities of many companies in a much more important capacity than is delegated to them at this time. In fact, it is quite possible that they might assume a much more important place than the accountant holds today.

That is the background. Now what of the future?

Where will more ceramic engineers be employed and how many? Of course, the increase in the present established positions with frit and chemical companies will probably follow the normal increase in production by these plants. The position of a ceramic engineer is settled largely in these two branches. It is not hard to imagine a 30 to 50% increase in production in these two fields in the next few years, so it will not be hard to assume an increased number of technical employees.

In the steel industry, undoubtedly greater attention will be given to the preparation of base metal upon which to apply porcelain enamel. Although this is fundamentally a metallurgical problem, the ceramic engineer will probably do much of the research work for these companies.

The biggest field, however, and the one which will show three to five times the possible usage of ceramic engineers, will be in operating porcelain enameling plants. These companies have not yet learned the importance of func-

tional foremanship, i.e., the splitting down of department responsibility, separating processing from production, and perhaps separating labor problems and inspection from both of these fields. As this specialization increases, the use of specialized men goes along with it.

In releasing a young ceramic engineer from the employ of a porcelain enameling company in 1923, the president said, "I don't see how we can find a place for you in this organization that will ever justify the salary which you expect to earn."

In other words, even though the company at that time was paying high prices for rule-of-thumb makers of ceramic products or "hip-pocket ceramic engineers," he did not feel that a technically trained man could properly serve that organization.

By 1933, managements had progressed in their thinking to the point where they were saying, "Much as we need you, we are sorry that we must let you go as we cannot afford to pay your salary." Here, too, they were again dispensing with what seemed to be an item of expense because they did not appreciate the important part which this younger group of men was playing in their industrial processing.

Witness the change to 1943 when the question was universally asked, "Where can we get you?" Although this was somewhat due to the force of labor shortage at this time, it was also due to the fact that ten years before discouragement had been thrown in the path of the younger engineers.

By 1953, the flat statement may be made, "We can't get along without you." This is a far cry from the statement made in 1923.

How many? Probably hundreds of ceramic engineers will be employed in this industry. Not thousands, because the industry is not big enough to use that many technical men. Certainly there will be no return to the tens that were employed before the early thirties.

The big future, then, for ceramic engineers is in the operating departments of porcelain enameling plants, but they must have some executive ability and training to rise above the technical levels of the men who control the processes in these departments.

PORCELAIN ENAMEL INSTITUTE
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WASHINGTON 5, D. C.

EDITORIAL

USE OF NONMETALLIC MINERALS IN THE CERAMIC INDUSTRY*

BY A. F. GREAVES-WALKER

It has been said that the belated recognition of the merits of the nonmetallic minerals can be attributed to (*a*) inadequate and obsolete methods of winning and beneficiating; (*b*) belief that the less familiar ores were available in only limited quantities; (*c*) failure to correlate academic studies with industrial needs; and (*d*) lack of sufficient research to determine industrial uses.

When the fact that no branch of engineering has been interested in the field of the nonmetallics as a whole is considered, it is little wonder that it has required the exigencies of two wars to bring them into prominence. That they have now made for themselves a permanent place in our mineral economy there can be no doubt.

Because a considerable number of the less common nonmetallics have come into use in the ceramic industry in recent years and are not yet widely used, many ceramic engineers do not realize how extensive the list has become.

Originally the ceramic subjects covered in the curricula of the departments of ceramic engineering were, generally speaking, structural clay products and whiteware. Courses in glass, enamels, cements and plasters, refractories, and abrasives have been added gradually. In the study of the original subjects, it was only necessary to cover a limited number of minerals, principally the clays, feldspars, and quartz. That situation has changed. Not only is it now necessary for the ceramic engineer to be familiar with the origin, production, physical characteristics, and uses of a large number of nonmetallic minerals, but, because quality control has become important, it now is necessary to study methods of beneficiating them, e.g., the work that has been done on the beneficiation of kaolins, fire clays, and feldspars. One feldspar flotation plant is now in operation, and a considerable amount of research on the separation and upgrading of the pegmatite and other nonmetallic minerals has been carried on during the war and is still in progress.

The following list, which covers the more important nonmetallic minerals which have found use in the ceramic industry, will give an idea of the extent to which ceramic engineers have become vitally interested in this field.

CLAYS: Little need be said of the importance of this class of minerals. They form the backbone of the ceramic industry. Their use has now extended into other industries with which ceramic engineers should become familiar.

DIATOMITE: This mineral has attained importance in the production of heat-insulation products.

FELDSPARS: The uses of the potash and soda feldspars are too well known to require comment.

GYPSUM: Another ceramic mineral which requires no comment.

QUARTZ AND QUARTZITE: These minerals are widely used in ceramics and need no comment.

TALC: The uses of talc in ceramics and particularly in steatite have increased during the war.

MAGNESITE: The principal source of raw material for producing basic refractories and magnesia cements.

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LOVITE: A lime bentonite which has found uses during the war.

EYRITE: A magnesium silicate which promises wider use in ceramic bodies.

VERMICULITE: This mica mineral, when expanded, is used in the production of insulating brick and cement-bonded building products.

BARITE AND WITHERITE: A surprisingly large tonnage of barite and barium compounds is used in the ceramic industry. Witherite is used to a small extent.

BENTONITE: The war has brought this mineral into a large number of uses, principally as a bonding agent for molding sands and as a plasticizer.

CELESTITE: The use of this mineral or strontium compounds produced from it in glasses and glazes is strongly indicated by research.

CHALK AND LIMESTONE: The use of these minerals in ceramics needs no comment.

PERLITE: A volcanic glass which when heated explodes like popcorn. It is bonded to form heat-insulating products or used as an aggregate in lightweight concretes.

BORAX: This mineral finds considerable use in ceramics and needs no further comment.

RUTILE: A titanium mineral used in ceramic bodies.

SELENIUM: A mineral used in the glass industry.

PYROLUSITE: For many years past this mineral has been used as a coloring agent in ceramics.

CRYOLITE: This mineral is used in enamels and glasses.

FLUORSPAR: Fluorspar is also used in enamels and to some extent in glasses.

CLINOCHLORE: This mineral has been found to have useful and valuable properties when used in ceramic bodies and promises to find considerable usage when it is made available in quantities.

LEPIDOLITE, AMBLYGONITE, AND SPODUMENE: These lithium minerals were used in ceramics to the extent of their limited availability before the war. During the war, the production has been greatly increased, which forecasts a wider postwar use, particularly in glasses and glazes.

KYANITE: Both the domestic and Indian types have become important raw materials for refractories. Low-iron domestic kyanite is important as an alumina additive in some types of glass.

ZIRCON AND ZIRCONIA: Zircon, known for its refractoriness for many years past, is now being used to produce superrefractories for special purposes in addition to its use as an opacifier and flux. Zirconia is also used in ceramics.

GARNET: This mineral has come into use during the war as a substitute for corundum in the grinding and polishing of precision lenses.

CORUNDUM: The best-known medium for grinding and polishing precision lenses. For certain metallurgical uses, natural corundum grinding wheels give higher efficiencies than those of artificial abrasives.

ANORTHOSITE: This mineral is being used instead of clay in the manufacture of Portland cement. In this connection, a new plant is being constructed to extract the alumina from the anorthosite ore as a by-product.

MICA: In addition to other uses, low-iron scrap mica is being ground or recovered in the beneficiation of kaolin, mixed with a bonding agent, fused, and pressed into dielectrics for radio and radar equipment.

WOLLASTONITE: This mineral is being mined in New York State and at present is processed primarily for ceramic welding-rod coatings. It is also finding some experimental use in ceramic bodies, which use, it has been predicted, will increase.

PERICLASE: Before the war, manufacturers of magnesite refractories were almost entirely dependent on the deposits of magnesite in eastern Washington and Europe. Since Pearl Harbor, several plants have been constructed to produce calcined magnesia and periclase. These plants use calcined dolomite and sea water or brines in the process. A considerable tonnage of periclase is now used in the production of refractories.

DIASPORE: This mineral has been used for the manufacture of high-alumina refractories for many years past.

DOLOMITE: This mineral also has been used for refractories purposes for many years past and now finds extended use in the production of periclase.

PYROPHYLLITE AND PINITE: The first-named of these aluminum silicates has found use in whiteware, and both are now used in refractories.

OLIVINE: Forsterite refractories are being produced from olivine. The U. S. Bureau of Mines has developed an electric-furnace process for producing practically pure forsterite from this mineral.

TOPAZ: A considerable tonnage of massive topaz has been used in the production of refractories during the past two years. The products have the same qualities as those made from Indian kyanite.

DUMORTIERITE: Its use in spark-plug porcelains is well known.

ANDALUSITE: Its use in spark-plug porcelains also is well known.

APLITE: The increase in the use of this mineral in ceramics during the war has been remarkable.

NEPHELINE SYENITE: The use of this mineral in ceramics is well known.

RUBIES AND SAPPHIRES: The cutting off of European supplies of natural stones used for jewel bearings in watches, clocks, and instruments and the lack of a sufficiently large source of the natural stones in this country made it necessary to develop synthetic products for this purpose. Synthetic rubies and sapphires are now produced in this country on a considerable scale, and the industry gives every indication of continuing after the war as a producer of synthetic gem stones.

ALUMINA: One of the new war developments which is of interest to ceramic engineers is the production of alumina from clay. The kaolins are mixed with limestone or limestone and soda and calcined. The calcine is leached and the alumina is precipitated. Two commercial plants are being constructed at present in addition to several in operation. Although this is not likely to develop into a large industry at present, the rapid depletion of our bauxite deposits, the source of ore for aluminum, indicates an expansion at some future time.

As the ceramic uses of many of these minerals have been developed since World War I, there is every reason to believe that the list will be extended during the postwar period. It is simply a question of research. The list,

however, is now sufficiently long to indicate that the ceramic engineers have a major interest in the production, beneficiation, and use of the nonmetallic minerals; in fact, ceramic engineering is the only branch of engineering that is giving formal training in this branch of the minerals industry.

The question now arises as to whether ceramic engineering curricula should be revised to include the study of not only the minerals now used in ceramic products, but all the nonmetallics used in industry. This question is of great importance to the profession at this time because the field is open. Neither mine engineering nor chemical engineering are devoting to it the time necessary to train nonmetals engineers. A recent survey showed that only about one per cent of the mining graduates go into the nonmetallic minerals field.

To cover the field, ceramic engineering curricula would have to be revised to some extent. It will be argued that this cannot be done without increasing the instruction time. This is not entirely true. The chemical engineers have to cover a much larger field than do ceramic engineers in the same length of time, and the chemical engineering educators have solved the problem by training them in unit operations and unit processes. The same method could be adopted in ceramic engineering. After all, most of the nonmetallic minerals are silicates, which greatly simplifies the teaching problem. C. W. Parmelee suggested adopting this method a few years ago, but at that time the suggestion received little attention from the educators.

Any attempt to cover the nonmetallic mineral field would involve good courses in winning, with emphasis on open-cut methods and explosives, and beneficiation processes, with emphasis on flotation.

Ceramic engineers and particularly ceramic educators should give this matter careful consideration. A large field for which no over-all specialized training has been provided is open to graduates of the future if but slight changes are made in the present curricula.

The use of the nonmetallics has expanded tremendously in the past few years and they have rendered services of inestimable value in the war program. Converting ceramic engineers into "nonmetals engineers" would do much toward giving them a national standing which they have not heretofore enjoyed. It would also provide a broader field of employment and thus permit the expansion of the ceramic engineering departments.

Office of Production Research and Development
War Production Board
Metals and Minerals Branch
Washington, D. C.

REPORT OF THE DEAN OF FELLOWS, 1943–1944

Through three years (March 30, 1941, to April 1, 1944) and two annual meetings (1942 and 1943) we have tried the experiment of having the Fellowship act as a Senior Advisory Council to The Society, with the duty assigned to it of hearing and discussing the reports of The Society's technical committees and of its technical representatives in other organizations and making recommendations thereon to the Trustees, whose primary concern is the business management of The Society and who consequently have not the time to consider technical reports in detail. Although a war period is hardly a favorable time for such an experiment, we can at least report the results so far obtained.

The experience of the first annual meeting and the year following it showed that the advisory function would have to be confined, for the most part, to the annual meeting of the Fellows and to the personal consultations that are possible during the Annual Meeting of The Society. As a result of the 1942 meeting, a number of recommendations were prepared for the Trustees during the second year of the three, mostly by means of correspondence between the Dean and various Fellows, but it became clear that this consultation by correspondence is a function better left to the Secretary and President, who are the responsible officers. The recommendations for 1943–1944 therefore came mainly from the Fellows' 1943 meeting itself. In both years, the Trustees have given respectful consideration to our opinions and have acted upon our recommendations, in most cases favorably.

We shall continue today, as at the past two meetings, our assigned function of acting as an advisory council on technical subjects.

One serious detriment to our acting as a satisfactory advisory council should, in fairness, be pointed out. The Fellowship is not a representative body. Its members are selected either because of their contributions to ceramic science and technology or because of their past services to The Society. Although the Fellowship may be expected to include many or most of the members who have The Society's concerns nearest their hearts, it can be viewed by the younger portion of The Society's membership as made up of all the old fogies whose first instinct is to oppose anything new or different. A truly representative council should have a place for the spokesman even of an unpopular minority who want to be heard.

At the 1943 meeting, in connection with some changes in the Rules that were up for consideration, the view was expressed by several Fellows that this annual meeting is just one more unnecessary meeting and that the present autonomous organization of the Fellows, with a Dean, Associate Dean, Secretary-Treasurer, and committees, had better be discontinued altogether. Hearing no contrary view expressed on the subject, the Dean had to conclude that this opinion was fairly general, though not necessarily that of a majority of the Fellowship. He therefore appointed a Committee on the Relations of the Fellowship to The Society, consisting of L. E. Barringer (Chairman), J. C. Hostetter, and W. K. McAfee.

Pending possible action to discontinue the formal organization, no nominations have been made to fill the post of Dean for the next three-year term and no appointments have been made to the Committee on Honorary Membership, as its function is one that may revert to The Society. Three new members have been appointed to replace retiring members of the Fellowship Board, as usual, and the Board has reported a preferential ballot on twelve nominees to the Fellowship. The Board yesterday elected eight of these to the Fellowship, namely, O. G. Burch, G. E. Crawford, R. E. Gould, F. C. Henderson, J. H. Isenhour, H. C. Plummer, M. Y. Seaton, and K. E. Smith.

Some progress has been made by the Dean on the proposed ceramic book list, turned over to us last year by the Institute of Ceramic Engineers. A satisfactory classification of subjects has been completed, based on the classification used by the International Institute of Bibliography, now in process of translation into English. This was adopted on the advice of E. H. McClelland, technology librarian of the Carnegie Library of Pittsburgh. The Society's list of about two thousand titles has been revised and partly assigned to the new classification. This is necessarily a one-man job until the material is ready for distribution for criticism.

April 2, 1944 —Robert B. Sosman, *Dean*

CERAMIC EDUCATIONAL COUNCIL

Minutes of Annual Meeting

The annual meeting of the Ceramic Educational Council was held in Pittsburgh, Pa., April 2, 1944. The luncheon meeting was called to order at 1:00 P.M.

President Robert M. Campbell presided and made introductory remarks. The minutes of the 1943 meeting, appearing on page 377 of the November 15, 1943, *Bulletin of The American Ceramic Society*, were approved as printed.

Selective Service matters were discussed by A. I. Andrews, Chairman of the Committee on Draft Status of Ceramic Students, and Dean M. E. Holmes, Chairman of the Committee on Recognition of Ceramic Engineering. The work of both committees being completed, a motion by A. I. Andrews, seconded by R. M. King, to discontinue the committees was put to vote and carried.

Chairman E. P. McNamara reported for the Committee on Extension Instruction, Postwar Rehabilitation, and Reemployment. C. R. Amberg and R. M. King discussed some aspects of occupational therapy, and Dean M. E. Holmes described the technical institutes proposed by the State of New York. Mimeographed copies of the Committee's report were distributed.*

Chairman C. M. Dodd, of the Committee on Ceramic Engineering Curricula, showed that few changes had been made in the curricula of the various schools in the past year. Mimeographed copies of the report were distributed.

The report of the Committee on Content of Ceramic Courses was presented in the absence of the Chairman, J. L. Carruthers. It was suggested by President Campbell that this Committee might investigate the amount of nonmetallics taught and should determine the relation of ceramic subjects to the licensing requirements of such states as New York and Michigan.

Chairman J. W. Whittemore discussed the activities of the Committee on Publicity.

Chairman M. J. Rice made a final report for the Committee on Semimicroqualitative Analysis. A motion (King, Hursh) to discontinue the Committee was carried.

The report of A. E. Badger, Chairman of the Committee on Physical Chemistry, was submitted. This pointed out that students do not realize the many applications of physical chemistry involved in ceramics and suggested that instructors in ceramics call attention to these. A two-semester course in physical chemistry was recommended.

The Committee on Textbooks, S. R. Scholes, Chairman, proposed that low student enrollments might afford some staff members an opportunity to prepare textbook material. After discussion, a motion (McNamara, Koehler) was carried for the appointment of a committee to investigate the possibility of compiling and publishing a Handbook of Ceramic Engineering. A motion was then made by S. R. Scholes, seconded by R. L. Stone, and carried, that the present Committee on Textbooks be discharged.

A. I. Andrews spoke for the Committee on Terminology, reporting progress. The Council decided to withhold action until definitions of "ceramics" and "ceramic engineering" have been received from The Society's Committee on Classification and Nomenclature.

Upon motions presented by Chairman J. F. McMahon of the Committee on Rules, and seconded by J. W. Whittemore and A. I. Andrews, Article ECR VII of the Rules of the Ceramic Educational Council† was changed to conform with the revised Rules of The Society, to read:

"(1) As soon as possible after each annual meeting, the President shall appoint a Nominating Committee consisting of three Council members.

"(2) Seven members of the Council may by petition appoint a second Nominating Committee consisting of three Council members.

"(3) The Nominating Committee or Committees shall report their slate or slates for officers of the Council, except Trustee of The Society, at the annual meeting of the Council."

Sections (4) and (5) were unchanged.

An amendment was carried to the effect that the Nominating Committee for the year 1944–1945 shall consist of two members to be elected by the Council and a third to be appointed by the new President.

The Nominating Committee, R. M. King, Chairman, then presented the slate: C. M. Dodd for President, A. I. Andrews for Vice-President, P. S. Dear for Secretary, R. M. Campbell for Trustee, and R. L. Stone and C. R. Amberg for Nominating Committee. A motion (Hursh, Scholes) that the report be accepted and the Secretary be directed to cast a ballot for the nominees was put to vote and carried.

Chairman Campbell introduced the new officers, and President-Elect Dodd assumed the Chair.

A. I. Andrews announced the acceptance by the Board of Trustees of a gift of $1000 as a trust fund from Industrial Publications, Inc., to be known as the *Ceramic Industry* and *Brick & Clay Record* Fund. This sum is to be distributed as $25 prizes to winners of local student speaking competitions to help pay their expenses to the student competitions at the Annual Meetings of The Society. A motion (King, Whittemore) was carried requesting the Trustee from the Council to propose to the Trustees of The Society that the Ceramic Educational Council be given the function of administering the speaking contests and the awarding of prizes.

The Council discussed, without action, the subject of inviting interested persons from the Institute of Ceramic Engineers and The Society to attend the meetings of the Council.

The meeting adjourned at 2:50 P.M.

—E. C. HENRY, *Secretary*

* See *Bull. Amer. Ceram. Soc.*, **23** [5] 164–65 (1944) for published report.

† See *ibid.*, **17** [10] 394–95 (1938).

REPORT TO ENAMEL DIVISION OF WORK OF COMMITTEE ON CLASSIFICATION AND NOMENCLATURE

The Committee has not had any formal meetings, but has had considerable correspondence covering the definition of such words as "ceramics," "ceramic," "ceramic technology," "ceramic engineering," and "ceramic art." There is still not sufficient agreement to bring the Committee close to the conclusion of its work, but considerable progress has been made.

There has been some rather strong objection to the inclusion of such words as "mining" in the definitions for both "ceramic" and "ceramic engineering." Criticism has been made of the use of such negative terms as "nonmetallic" and "inorganic." From more than one source, it has been suggested that emphasis should be placed on the fact that the ceramic field deals largely with oxides and silicates and, in general, this idea has been incorporated.

It is planned that the Committee will continue this work with particular emphasis on the etymological aspects of the problem.

—G. H. MCINTYRE, *Member, Committee on Classification and Nomenclature, Enamel Division*

REFRACTORIES DIVISION

Minutes of Annual Meeting

Date: April 4, 1944
Time: 1:15 P.M., E.W.T.
Place: Urban Room, Hotel William Penn, Pittsburgh, Pa.
Presiding Officer: C. L. Thompson, Division Chairman

The meeting was called to order by the Chairman.

S. M. Swain read the minutes of the previous meeting together with the financial report. It was regularly moved and seconded that the minutes be approved as read The motion was carried.

S. F. Walton read the report of the Rules Committee recommending adoption of the proposed amendments to Article RR VII of the Rules of the Division regarding nominations and elections, published in the February 15, 1944, *Bulletin* of The Society (p. 58). L. J. Trostel called attention to the fact that provision has been made for write-ins on the ballot and also provision for a slate of nominees by any group of five Division members. Mr. Walton explained that space for write-ins is in accordance with the Constitution and By-Laws, also that if a slate is proposed it must go through the regular channels provided for in the rules and regulations. Mr. Trostel then asked if, when the name of a candidate is written in on the ballot, the voter must have obtained the consent of the candidate. Mr. Walton replied that no provision had been made to require the nominee's consent on write-ins.

A member asked if, when a group of five proposes a new slate of candidates, the proposed slate must be known 90 days in advance of the Annual Meeting. Mr. Walton said any slate should be sent in to the Chairman of the Division 90 days before date of the Annual Meeting and given to the General Secretary of The Society 70 days in advance of the Annual Meeting. Dr. Thompson recalled that it has been an unwritten rule of the Division for many years to follow normal advancement of officers, so that the probable slate would be known to members of the Division well in advance of the 90-day period.

Upon motion regularly moved and seconded it was unanimously carried that the new Rules be accepted as read.

R. S. Bradley gave the report of the Nominating Committee, announcing that the officers elected for the coming year were as follows:

Chairman: W. R. KERR, Armstrong Cork Co., Beaver Falls, Pa.
Vice-Chairman: S. M. SWAIN, North American Refractories Co., Cleveland, Ohio.
Secretary: E. E. CALLINAN, Timken Steel & Tube Co., Canton, Ohio.

Mr. Bradley reported that G. J. Easter, C. L. Thompson, and J. B. Austin will constitute the Nominating Committee for the coming year. Following the provisions of the new regulations, C. L. Thompson automatically becomes Chairman of the Nominating Committee as retiring Chairman of the Division; J. B. Austin is a member as Division Trustee; and G. J. Easter, as the third member, has been appointed by the new Division Chairman and approved by the Division Executive Committee. Upon motion regularly made, seconded, and unanimously carried, the report of the Nominating Committee was approved as read.

E. E. Callinan, Chairman of the Program Committee, thanked the members of his Committee and those of the Division who had so generously helped him in planning the program for the Annual Meeting.

G. B. Remmey, Chairman of the Membership Committee, reported that four new members were gained during the previous year.

C. M. Dodd of the Committee on Classification and Nomenclature read M. F. Beecher's report to the Trustees.

The preceding Committee reports were duly voted to be approved as read.

D. W. Ross, of the Research Committee, and O. L. Jones of the Industrial Management Committee, were absent and no reports of their Committees were given.

C. L. Thompson introduced E. B. Read as incoming Program Chairman.

There being no old business nor new business to be discussed, the motion was duly made, seconded, and unanimously carried that the meeting adjourn at 1:45 P.M.

The preceding minutes have been approved by the Executive Committee of the Refractories Division for publication in accordance with the By-Laws of the Division.

—S. M. SWAIN, *Secretary*

UPSTATE NEW YORK SECTION

The regular meeting of the Upstate New York Section of The American Ceramic Society was held May 26 at the Baron Steuben Hotel, Corning, N. Y., with about one hundred in attendance.

Before this, the Chairman assembled the members of the Program Committee, consisting of M. H. Berns, H. R. Lillie, H. Failmezger, M. E. Holmes, R. E. Gould, and E. E. Kunzman. After much discussion, they decided to hold the next meeting at Hornell the Friday evening before the annual meeting of the New York State Ceramic Association. Tentatively, if the N.Y.S.C.A. meets on October 7, the Local Section will meet October 6. It was then voted that the Charter shall remain in the possession of the Chairman of the Local Section.

After an enjoyable dinner, Chairman Berns welcomed all present and announced that The American Ceramic Society had decided to hold its 1945 Annual Meeting in Buffalo April 16 to 19. He then called on Ross Purdy, who discussed the first beginnings of American glass research and how the glass industry tied in with ceramics. E. C. Sullivan and Frank Day, Jr., of the Corning Glass Works, spoke briefly, after which W. C. Taylor of the Corning Glass Works introduced the speaker of the evening, James Bailey, Vice-President of the Plax Corporation. Mr. Taylor gave a background of the speaker's history from mechanical engineer through glass technologist to his present field of plastics.

Mr. Bailey then covered the broad field of plastics in a capable fashion, tingeing even the most technical passages with his characteristic calculated humor. Plastics are definitely the glamour materials of the age. Their possibilities have been grossly overestimated in a great many cases, as they are not universal cure-alls due to several disadvantages. They do have a wide scope, as out of 450 thousand listed chemicals, one-half of this number can be used by the plastics industries. In 1943, 951 million pounds of plastics were used having a raw material value of $362,000,000. The postwar program of plastics looks toward tying in with other industries and growing with them rather than competing with them.

He then gave a quick but comprehensive review of the various modes of manufacture and discussed some of the properties and uses. Plastics absorb energy due to hysteresis, which partially explains the failure of synthetic rubber tires at high speeds. They do not return to shape immediately after deformation, hence the energy absorbed soon heats the tire to a point of failure. Plastics have low heat conductivity, an advantage in some cases but disadvantageous in others. They cannot be used in extremely large units because of their high thermal expansion and they have low stress-carrying capacity. The outstanding advantage lies in their ability to be molded around a multitude of inserts. After discussing all of the disadvantages of plastic materials, the speaker displayed a trunkful of assorted products, trinkets, and gadgets, the variety of which showed that plastics are not just a passing fancy but a definite tool of science and industry.

—E. E. KUNZMAN, *Secretary*

CHICAGO SECTION

The second of the 1944 series of meetings of the Chicago Section was held in the Electric Club May 26, 1944. Twenty-one members and guests were present.

Following the usual dinner, the meeting was called to order by Chairman Hugo Filippi and a short business session was held. The officers of the Section presented a favorable report in respect to affiliation with the Chicago Technical Societies Council. The report was accepted and the Section voted unanimously to become a member of the Council.

A Nominating Committee, consisting of Fred L. Steinhoff, Industrial Publications, Inc., Chicago, G. G. Hanson, Colorado Feldspar Co., Canon City, Colo., F. E. Hodek, Jr., General Porcelain Enameling & Mfg. Co., Chicago, W. G. Martin, A. O. Smith Corp., Milwaukee, Wis., and

J. S. Offutt, U. S. Gypsum Co., Chicago, was appointed to submit a slate of nominees for Section officers for the coming year. This Committee will report at the next meeting of the Section.

The program arranged for the evening was one of unusual interest, especially to those engaged in the local brick industry. J. E. Lamar, geologist and head of the Industrial Minerals Division of the Illinois State Geological Survey, Urbana, Ill., presented the first paper entitled "Geological History of the Chicago Area with a Discussion of the Occurrence and Distribution of the Glacial Till and Physical and Chemical Characteristics of the Local Deposits." This paper was extremely informative and provoked an extended discussion.

The second paper of the evening was presented by R. K. Hursh of the Department of Ceramic Engineering, University of Illinois, Urbana, Ill., and was divided under the following subheadings: (*a*) A discussion of the methods which might be employed to beneficiate the till, such as chemical treatment, washing, and centrifuging; (*b*) a suggested list of products which could be manufactured from the local material after beneficiation; (*c*) production problems that would be involved in manufacturing higher-grade ware from the improved raw material.

Professor Hursh discussed the extremely variable physical and chemical composition of the local clay deposits and pointed out the difficulties and expense that would be involved in beneficiating the raw material sufficiently to permit its use in manufacturing products of a better grade than common brick for which the clay is exclusively utilized at present. He also pointed out the difficulty in improving the color of the fired clay owing to its high alkali content and to other undesirable components. Although no definite recommendations could be made, it was suggested that investigation and research might lead to a practical utilization of the local clays for the following new products: (1) Lightweight blocks or brick made by a process involving the addition of chemicals or organic matter and firing to a suitable temperature; (2) rock wool made of a mixture of the raw clay and local dolomite; (3) colored clay brick made by the application of a slip or a dry material to the surface of the clay column before firing; (4) lightweight aggregate.

Professor Hursh spoke extemporaneously from notes but admirably covered his subjects in a clear and frank manner. His remarks provoked an extended discussion of the problems that would be involved in manufacturing any of the new products suggested by him.

Dr. Lamar and Professor Hursh are to be complimented on the excellence of their papers, and both made a valuable contribution to the present knowledge of the ceramic properties of the glacial till of the Chicago Region.

—J. J. SVEC, *Secretary*

Upstate New York Section Meeting
Sherwood Hotel, Hornell, N. Y., Friday October 6
New York Ceramic Association Meeting, Alfred, N. Y., Saturday, October 7

PORCELAIN ENAMEL INSTITUTE ELECTS OFFICERS

The following officers were elected at the thirteenth annual meeting of the Porcelain Enamel Institute held June 6 and 7 in Cleveland, Ohio.

President: R. H. TURK, executive vice-president of the Pemco Corp., Baltimore, Md.

Vice-President: O. J. HEYER, president of the Chattanooga Stamping & Enameling Co., Chattanooga, Tenn.

Vice-President: JOSEPH T. PENTON, president of the California Metal Enameling Co., Los Angeles, Calif.

Treasurer: WILLIAM HOGENSON, president of the Chicago Vitreous Enamel Product Co., Cicero, Ill.

Following the acceptance of the resignation of Charles S. Pearce as secretary and managing director, Edward Mackasek was elected to this post. Mr. Mackasek was formerly executive vice-president of the Beaver Enameling Co., Ellwood City, Pa. He will be located at the Institute headquarters in Washington, D. C., where he has been acting as development engineer for the last six months.

Mr. Pearce resigned his post to become Associate Secretary of The American Ceramic Society.

Richard H. Turk

Richard H. Turk has long been active in the affairs of the Porcelain Enamel Institute, having served as vice-president for several years. Still a young man, he has spent a long number of years in the porcelain enameling industry and for the past twenty years has been actively associated with the Pemco Corporation. He was elected a Fellow of The American Ceramic Society in 1936 and with his father, Karl Turk, Sr., was the recipient in 1940 of the Modern Pioneers Award presented by the National Association of Manufacturers. In his acceptance address, Mr. Turk emphasized the need for even greater effort on the part of manufacturers, as follows: "Forward thinking and planning need to be pushed from the academic to the productive stage. It is generally conceded that the porcelain enameling industry will be one of the most active in postwar days because it is so closely related to the home-appliance industry. Our ability to cope with new and larger problems has been proved by our performance during the early days of the war. Our industry was one of those that ceased to exist because of Government decrees. We did not pull up the awnings and bolt the doors—we undertook entirely new work. In most cases, this was quite foreign to our normal business, yet we did a job often better than those having years of experience in that particular line. We should be proud

Richard H. Turk

of our accomplishments and take from them much confidence to meet the demands the future will place upon us, no matter what they may be. The coming demand for intense production may be a pitfall for us if we give so much attention to volume that we fail to produce the quality the public inherently expects of our finish. While we must meet the demand for much in a short time, that much must be our best."

JESSE T. LITTLETON HONORED

Jesse T. Littleton, vice-president and associate director of research of the Corning Glass Works, Corning, N. Y., was awarded the honorary degree of Doctor of Science by the University of Wisconsin at the annual commencement exercises of the institution at Madison, Wis., May 27 in recognition of his contributions to the world's knowledge of glass and its uses.

Presentation of the degree was made by Clarence A. Dykstra, president of the university. Dr. Littleton was the only recipient of the degree of Doctor of Science. Two others were awarded the degree of Doctor of Laws for their work in fields other than glass.

In making the presentation, President Dykstra observed that Dr. Littleton had received his degree of Doctor of Philosophy at the University of Wisconsin thirty-three years ago. He also had been a research fellow and an assistant in physics at the University of Wisconsin.

The citation accompanying the award reads: "Jesse Talbot Littleton, graduate of this university and even now wearer of our doctor's hood, scientist who left the campus for the industrial laboratory, at present associate director of research in a great industrial plant, contributor extraordinary to our knowledge of the properties of glass and extender of its uses and usefulness, participator in the solution of the challenging problem of developing and successfully building the great 200-inch mirror which will bring the heavens infinitely closer to students of the stars in that great Pacific Coast Observatory, physicist who has drawn to his laboratory many Wisconsin graduates for further study and technical training, investigator and stimulator of investigation, the university which conferred upon you the degree of Doctor of Philosophy now adds to that the honorary degree of Doctor of Science.

"Upon the nomination of the faculty and the vote of the regents of the University of Wisconsin, I admit you now, by virtue of the authority vested in me, to the honorary degree of Doctor of Science."

A biographical sketch of Dr. Littleton, a Fellow of The American Ceramic Society, appeared in the May, 1940, *Bulletin*, pp. 182–84.

HAROLD E. SIMPSON RESEARCH FELLOW FOR MISSISSIPPI GLASS COMPANY

Mellon Institute, Pittsburgh, Pa., has announced the appointment of Harold E. Simpson to the incumbency of an industrial fellowship in that institution whose program of research and development will be sustained by the Mississippi Glass Co., 200 Fifth Avenue, New York 1, N. Y., the president of which is J. C. Hostetter. The investigations of the fellowship will be concerned with rolled or drawn glass, plain or wired, used principally for fenestration and for other structural purposes, and methods of finishing and decorating such glass.

Dr. Simpson, who has been associated with Mellon Institute for eight years, is well known professionally for his research accomplishments in ceramics. In the past, he has successfully carried out a number of broad studies pertaining to important problems of glass technology. He has been especially active on committees of the American Society for Testing Materials and The American Ceramic Society. Inasmuch as the products of the Mississippi Glass Company are of particular value in building construction today and tomorrow, Dr. Simpson's long experience on structural materials makes him unusually well qualified for heading this new undertaking.

A biographical sketch of Dr. Simpson, a member of The American Ceramic Society since 1924, appeared in the March, 1944, issue of *The Bulletin*, pp. 109–10.

FELLOWSHIP OPPORTUNITY

The Ceramic Engineering Department of the Missouri School of Mines is offering a fellowship of $1500 per year leading to the Doctor of Philosophy degree. Part of the time must be spent in determining chemical analyses of clay samples. Anyone interested should write to the Dean, Missouri School of Mines, Rolla, Mo.

GLASS CONFERENCE AT UNIVERSITY OF ILLINOIS

To Be Held in November, 1944

The Department of Ceramic Engineering of the University of Illinois is planning to hold a Glass Conference early in November in Urbana, Ill. This meeting will be the eighth of the series which was started in 1934.

These conferences are planned as discussions of problems of interest to the operating personnel of glass factories. The program under consideration will consist of a survey of glassmelting practice. Tentative subjects of talks to be delivered by various men from the glass industry are as follows: (1) Batch preparation, (2) glassmelting reactions, (3) improvements in furnace design, (4) furnace operation, (5) temperature distribution in tanks, (6) heat transmission through molten glass, (7) post-mortem observations of tanks, (8) electric melting of glass, and (9) economic factors affecting location of glass plants (after-dinner talk).

Programs will be mailed to the personnel of glass companies as soon as the program is definite.

CHANGES AT METAL & THERMIT CORPORATION

Homer F. Staley, Manager of the Ceramic Department of the Metal & Thermit Corporation, New York, N. Y., retired May 1, 1944, after twenty-three years of service. He was the honored guest at a testimonial dinner given by his many friends and associates in the Metal & Thermit Corporation at the Waldorf-Astoria Hotel in New York City.

R. R. Danielson, who has been associated with Mr. Staley as Director of Ceramic Research for the past eighteen years, has been appointed Director of Ceramic Service. He will also continue to direct the development work in connection with the Company's ceramic products and their applications at their Ceramic Laboratory, Carteret, N. J.

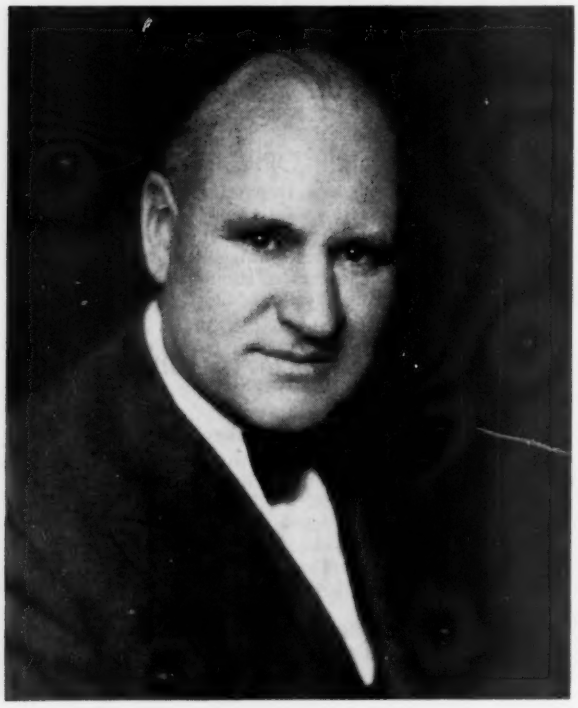
George C. Betz, formerly connected with the Star Porcelain Company and the Foote Mineral Company, has been appointed Sales Manager of the Chemical Division of the Metal & Thermit Corporation with offices at 120 Broadway, New York, N. Y. He will be in charge of the sales of all ceramic chemicals and opacifiers.

DRAKENFELD LOSES ASSOCIATES

The B. F. Drakenfeld & Co., Inc., New York, N. Y., has reported the death of two of its associates.

Martin F. Plage, who had been with the Company for forty-five years, passed away at the age of sixty-one at his home in Manhasset, L. I., May 21.

C. Nick Muessig, who retired January 1, 1935, after fifty-two years of service with this Company, died at the age of seventy-eight at his home in Forest Hills, L. I., May 25. Mr. Menssig was a former member of The American Ceramic Society.



Dr. Zay Jeffries

DR. ZAY JEFFRIES ON BATTELLE BOARD OF TRUSTEES

Dr. Zay Jeffries, noted scientist and a pioneer in tungsten metallurgy and in the development of high-strength aluminum alloys, has been elected to the board of trustees of Battelle Memorial Institute, Columbus, Ohio.

Dr. Jeffries is technical director of the Lamp Department of the General Electric Co., Cleveland, Ohio; chairman of the Carboloy Co., Inc.; and vice-chairman of the War Metallurgy Committee of the National Academy of Sciences and National Research Council.

NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL

This is an important announcement from the Office for Emergency Management, War Manpower Commission.

The National Roster of Scientific and Specialized Personnel in the War Manpower Commission is the agency of the Federal Government which, since 1940, has served as a central registry for persons possessing professional or scientific qualifications. All professionally qualified young engineers, chemists, physicists, geologists, mathematicians, etc., should be registered with the National Roster and if you have personnel in your employ who possess the necessary qualifications and who have not yet registered with the Roster it is important to the war effort that you ask them to do so.

The Roster has been assigned the responsibility of obtaining the best utilization of professional and scientific personnel. The Roster maintains records of those of its registrants who are working in war industries as well as those who have gone into the armed forces, whether in an officer or enlisted capacity.

In the light of recent Selective Service directives which will result in the induction of many thousands of professionally and scientifically qualified young men under the age of 26, it is important that these particular individuals who will enter the armed forces immediately notify the Roster of the branch of the armed forces they are entering, the date and place of their induction and, after induction, their serial number.

Obviously the Roster, as a civilian agency of Government, has no responsibility in the assignment of its registrants within the armed forces. At the request of the War and Navy Departments, however, the Roster does furnish advice to the Office of the Adjutant General, War Department, and the Bureau of Naval Personnel, Navy Department, concerning the specialized training and qualifications of those of its registrants who are inducted into the Army or Navy. This information is used as an aid in determining the initial military assignment of the particular individual.

It is conceivable that it may become imperative in the future, near or distant, to withdraw a number of professionally and scientifically qualified men from the armed forces to assign them to important research or production work in civilian war industry.

Communications should be addressed to the National Roster of Scientific and Specialized Personnel, 1006 U St., N.W., Washington 25, D. C.

MATERIAL-HANDLING METHODS*

By Ezra W. Clark

Abstract

This paper shows that unskilled labor adds nothing to a product except cost. Methods of reducing unskilled labor to a minimum are developed.

I. Introduction

Structural clay products formed the building material in the dawn of human history and continue to occupy a most important place in modern industry.

A mere recital of the upward progressive steps in the history of this industry will not contribute to the enlargement of your mental vision, to the efficiency of your operating routine, or to the economy of your distribution. You must have vital, factual data and sound conclusions to enable you to do a better job on a profitable basis in the postwar period.

The brick and clay industry has always been burdened with heavy labor costs. My theme may be summarized in a few words: *Unskilled labor adds nothing to a product except cost.*

II. A New Kind of Competition

The postwar period, after an interim devoted to reorganization, will be characterized by an intense, but different kind, of competition. Formerly, competition was fierce between companies within one industry (limited in the brick and clay field by geographical boundaries);

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 4, 1944 (Structural Clay Products Division). Received April 11, 1944.

in the postwar era, industries will compete against each other for available markets. You will face a man-sized job in your struggle for company prosperity and industrial self-preservation.

The brick and clay industry will compete with concrete, plastics, lumber, metals, and the prefabricated building. Let us assume that clay products are the ideal building material. Let us further assume that the building industry will lead all other industries in postwar activity. Your problem is to maintain the place of clay products in the building boom, and thus honestly win your share in the postwar prosperity. It can be done!

This industry will have its share of postwar burdens and handicaps. The tax load may be shifted but it will still be heavy. The American spirit is resilient, both in individual and corporate management; already there are lights on the political horizon which foretell hope for free enterprise and a lessening of the pain caused by selfish pressure groups.

Enlightened management is now putting its house and plant in order. Let us square the facts with the theory.

Quality, price, and marketability will be the deciding factors in the near future; we will not have a seller's market but a buyer's market.

No one knows when, but everyone knows certainly, that the iron hand of Government will be lifted from private enterprise and orders will be filled by those companies that have the right goods at the right price in the right place.

Unless this condition prevails, we shall not have a right America as we know it.

Labor in the brick and clay industry represents 57% of all costs; of this cost, more than 28% is unskilled labor.

American prosperity is based on an equitable distribution of costs, where labor and management work as a winning team. But may we not go a step further and study the ideal brick and clay plant where the ratio between skilled and unskilled labor continually changes in favor of skilled labor.

Instead of an equal division of the labor factor in brick and clay production, giving to each approximately 28 or 29% of the primary cost, perhaps we may attain a position where the labor cost shall be distributed 32% skilled and 17% unskilled, or, better yet, 12% unskilled labor; the more the skilled labor the more efficient the machine production, the lower the cost, and the better the quality of the product. Is this not a worthy object toward which to fight—a decreased labor cost factor through an increased skilled labor factor?

In the last few years, the cost of skilled labor has increased steadily from 50 to 75¢; from 75¢ to $1.00; from $1.00 to $1.25 or $1.50 per hour, an increase of approximately 40 or 50%.

In the unskilled field, wages have increased from 25 to 40¢, to 50¢, to 75¢, and $1.00 per hour. A recent ruling of the War Labor Board applicable to one manufacturer established a rate of 78¢ an hour for unskilled labor.

Skilled labor has increased 50%, whereas unskilled labor has increased 100%, or perhaps an average of 200%.

Because there is more unskilled labor than skilled labor, the ratio of increase has been greater in the unskilled field.

Wages do not have a tendency to retreat! Skilled rates in the postwar era will decline slowly, if at all.

Unskilled labor rates may break here and there; then they will hold the line, nationwide.

Brick and clay management, with a labor cost factor of 57%, must plan now to change the percentage or ratio of skilled and unskilled labor within its plant. This is how it may be done.

III. Improve Your Material-Handling Methods

Modernize not only by the substitution of mechanical and power-driven handling equipment for manual labor to reduce the sum total of labor costs (whittling away at the 57%, but at the same time increasing the quality of the product), but by decreasing the percentage of spoilage or waste in production, providing adequate and convenient storage, and facilitating shipment and delivery. It is a large order! But it would be no compliment to the men of this industry if they were given light, easy tasks.

Cheap labor is a thing of the past. Unskilled labor is the most expensive part of your labor factor. Fifty and even forty years ago there was a great influx of European labor into the United States. The last big year, however, was 1921, when nearly one million immigrants were admitted to the United States. In 1931, the number had dwindled to less than 100,000, and although many millions in Europe would like to escape the hard struggle there after the war, the immigration barriers will be kept up and there will be no great influx of cheap, foreign labor.

From charts in the December, 1943, issue of *Brick & Clay Record*, it would seem that the labor costs in the brick and clay industry are as high, if not higher, than in any other of our leading industries. This is in face of the fact that the selling cost per thousand, or per ton of brick, is comparatively low—a ceiling price more effective than a Government edict, as this selling price has been set for generations by competitive, although less desirable, building materials.

There may be some adjustment of prices between competitive products, but in the brick and clay industry, where the labor cost factor averages 57%, management will be faced with the hard task of producing in the next few years near the comparable cost of 1937; your unskilled labor factor is still a big percentage of your cost, and unskilled labor is 200% higher than it was at that time.

It is conservative to say that unskilled labor in the brick and clay field will cost, in the postwar era, a dollar an hour. You must answer the questions, "Is the unskilled labor today as efficient as it was fifteen years ago? Do you get a full hour's work for an hour's pay?"

What can improved material-handling methods offer in the way of production, storage, and distribution?

Clay plant management is to be complimented for the progress that has been made in this particular field over the last thirty years. Power diggers, industrial railways, and bucket and belt conveyers have all entered the picture and contributed to the lowering of the labor cost per ton of production. Study this problem in your own plant; see if the manufacturers of equipment for the moving of bulk materials can help you.

This field is left to the engineers of those manufacturers who have contributed so greatly to the movement of bulk and raw materials over the past two or three decades.

There is one point, however, in production where costs should still be watched.

Fifty per cent of this industry fires its kilns with coal and the remainder with oil or gas. Twenty-five years ago, our company designed and built a hopper-model industrial truck that would carry a cubic yard or even two tons of coal for the fueling of kilns. It was widely used, and some of these machines are still doing honest duty on their jobs, taking the place of wheelbarrows.

The percentage of use, however, has been declining steadily because of the increased use of fluid fuel (gas or oil) and the adoption of fixed conveyers for fueling. You are to be congratulated on the adoption of thermostatic heat-control devices which assure a more perfect product.

IV. Handling the Finished Product

The greatest strides in the reduction of unskilled labor costs have been accomplished by power-driven industrial trucks in the removal of the finished product from the kiln and its transportation to storage and thence shipment to use.

The early twenties saw the development of the gas-powered platform truck. Skids were loaded within the kiln, removed by the power truck, and transported to storage against the day of use. This method reduced spoilage and breakage that were present when wheelbarrows were used, and the percentage of the labor cost in the total production cost fell rapidly.

In the late twenties, a fork truck, a power unit equipped with elevating steel forks that will handle from one to three tons, was developed for use in the steel and heavy products industries. This truck required the use of a pallet on which the material to be moved was loaded.

The fork truck was soon adapted to the brick and clay field for moving the finished product.

The initiative of individual plant management developed new methods. The fork truck was not designed for long hauls, so management married the fork truck and pallet to the tractor-trailer system and produced a combination which promises to reduce unskilled labor costs tremendously.

A pallet, 36 by 48 inches, is placed on the deck of a trailer and pushed to the kiln where it is loaded with fired brick. This process is repeated until a train of trailers, each carrying a loaded pallet, is available outside of the kiln.

This train is towed by a small industrial tractor to the place of storage where another fork truck unloads the pallet, places it in storage, and tiers the next pallet on top of it. Pallets loaded with clay products may be tiered as high as 10 feet for storage.

The picture is not too optimistic. It is not all "beer and skittles." The use of modern material-handling equipment in the brick and clay industry for the reduction of unskilled labor costs requires the improvement of pavement and runways in the plant. We recommend for this a base of broken bats, or spoiled product, heavy rolled for a foundation on which reinforced wire is placed and then a concrete slab poured. The cost of this improved paving will be paid for by the savings over a few months.

The ingenuity of management in this industry is at least equal to that of other industries, and brick and clay plants are now utilizing the fork truck-pallet system, but have eliminated the pallet.

This is accomplished by the use of a template or the placing of several rows of brick that provide entrance for the lifting forks. The load of brick is handled as a unit by the use of multiple forks. Upon arrival at the point of storage, foundation brick are arranged in corresponding position, and the truck deposits its load in the same condition as when picked up. In one installation where the brick are made with holes, wires are run through these holes; when the forks on the lift trucks pick up the load, the wires hold the entire pile together and it is handled as a unit.

In every case, regardless of the detailed method of handling, an entire unit of 800 brick, weighing 2 tons, or of 1000 brick weighing 3 tons, is handled by one man; he may stack them 10 feet high for storage or take them direct to car or truck.

With the fork truck system, the inherent and costly problems of the wheelbarrow are not only eliminated, but also the use of extra men on top of the pile to catch the brick tossed up to them, if the ware is to be stored 10 feet high.

Fork trucks run at about 7 miles per hour, and one man and one truck may handle and transport 6000 brick or 13 tons in 18 minutes; in another instance, two men with two fork trucks loaded 50,000 brick, or 125 tons on trucks in 2 hours.

The less manhandling of the product, the smaller the percentage of loss or spoilage due to broken or damaged ware. Damage may run as high as 5%; if the runways are not smooth and the wheelbarrow men are careless, spoilage will exceed 5%.

Let us assume that a brick plant producing 100,000 brick per day has a spoilage of 5% or 5000 brick. The cost of this spoilage at 1¢ per brick is $50 per day. This is dead loss *plus*, because the spoilage has to be moved to the dump.

Every 1% reduction in total spoilage loss is actually a 20% saving. On a 100,000 daily production, this means a saving of $10 per day.

One hundred thousand brick at 1¢ per brick equals $100 production cost per day. If 28% of this $100 is unskilled labor, $28 represents unskilled labor cost per day.

If management, by the introduction of modern material-handling methods, can save only one-fourth of the 28% of unskilled labor involved, it will save $7 per day per 100,000 brick, plus $10 for each percentage of spoilage saved.

Is it worth your while to save $17 per day—whittling away at the 27%? One machine has saved six men per day at an average of 70¢ an hour, or a total saving of $33.60 per day.

The production manager of a brick and clay plant should look immediately to the proper paving of his runways and storage spaces and then install modern fork trucks, together with tractor and trailer trains to handle the product from the kiln to the storage sheds.

V. New Methods of Storage

It is not necessary to concrete storage areas if a good foundation is installed and a pallet system is used. The

pallet remaining under the pile of brick distributes the bearing pressure over a wide space and provides orderly storage. The runways and pickup areas for the fork trucks must be well paved.

If the template or spaced-brick and multiple-fork methods are used, better paving conditions must prevail in the storage areas. The paving expense required when fork trucks are used will be quickly amortized by the savings in unskilled labor.

Any large manufacturer of material-handling equipment should provide engineering assistance to prospects and customers in any given field. Our company maintains such a service and will be glad to place their talent at your disposal when requested by a responsible representative of management.

VI. Reducing Costs in Shipment

Brick and clay products may be shipped direct from kiln to user or may lie in storage for a few months and then move out to the user. In any event, the high expense of unskilled labor must be reduced, and here again progressive brick and clay plants are utilizing modern material-handling methods and equipment. If the pallet system is used, the pallet will be picked by the fork truck from storage, placed in the car or truck, and the integral pallet load may go directly to the point of use. The pallet should not be unloaded and the brick or product stacked by hand.

Some manufacturers control their product from the place of production to the point of use because they deliver the bulk of the product by motor truck. In this case, the pallet method is recommended because pallets returned may be used time and time again.

If the shipments go by rail, the full template or the template improvised from brick should be used. This enables the fork truck to deliver the entire unit load of brick into the car without the necessity of rehandling within the car. It is an entire machine operation, except for the small amount of manual labor needed to fill in open spaces in the car to prevent shifting of brick en route. This small amount of labor can be reduced materially if dunnage and steel strapping are used to position the brick and hold it against shifting while the cars are under way.

The Fontaine System of delivery by truck handles a unit load of 500 brick and delivers them on the job in a neat pack without rehandling. Four thousand brick may be carried on one truck. This is economical, saving damage in breakage, and makes a pile on the job far more attractive to builder, contractor, or architect. It helps sell the product!

Under certain conditions where the utmost flexibility is unnecessary, some clay products plants have found roller conveyers to be an ideal method of handling brick from the kilns, and at another plant an extensive monorail conveyer is used; six brick are handled as a unit hung in a frame fastened to the monorail.

Another development is the use of tunnel kilns to eliminate the back-breaking labor of setting intermittent kilns.

The use of fork trucks, as mentioned previously, for the handling of the finished ware from the intermittent kilns, works equally well on tunnel-kiln output.

VII. Conclusion

This industry will face competition from other industries that have been highly developed and mechanized by the necessity of war. To hold your place among the industries of the nation, you must produce in the postwar era a superior product at a low cost and deliver it in usable condition to your customer with the least percentage of spoilage. I have every confidence in the stamina and acumen of management within the clay products industry. You have a hard task but you will accomplish it. Let us hope, however, that time and foresight will enable you to accomplish it without financial loss.

All American industry will have a difficult time holding its place in the postwar world because we must meet the competition of millions of unskilled labor in Europe and the Orient, people whose standard of living will be far below that which prevails in America so that they can underbid American products in the markets of the world.

The only way that we can hold our place is to develop a national thought in each industry so that the percentage of unskilled labor decreases within our production while the percentage of skilled labor increases.

We must make our machines do the work of many men and again I say to you, *unskilled labor adds nothing to a product but cost.*

Perhaps this is the key that will open the door to a better future for the brick and clay industry.

CLARK TRUCTRACTOR
DIVISION OF CLARK EQUIPMENT COMPANY
BATTLE CREEK, MICHIGAN

POSTWAR-HOUSING RELATIONSHIP TO INDUSTRY*

BY IRVING W. CLARK†

I. Introduction

More than a million housing units are needed annually in this country of ours for a period of at least ten years, if American housing standards are even to approach the balance of our living economy. Astronomical as this projection may appear, it is based on sound, factual data. Annual net family increases, replacements of units destroyed by catastrophe or demolished as substandard or for commercial expansion, require about 900,000 new units annually, whereas our rate of building for the last ten years has averaged 350,000 units yearly. A huge need-backlog therefore has accumulated which brings our total annual postwar requirement well above the million mark.

To evaluate properly the probable actual housing con-

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struction, however, certain premises must be established, as follows:

(1) That the peak postwar year will probably be 30% above production in 1940.

(2) That all monetary value references are based on 1940 dollars.

(3) That the starting point for housing construction projections will be the end of the war with both Germany and Japan. Although there undoubtedly will be some relaxation of present housing restrictions, possibly before the end of the German phase of the war and certainly between the German phase and the final blow to Japan, the number of units that will be so constructed will be comparatively small. The importance of the units built during this interim will lie in the stimulation which they will give to the housing industry in preparing itself for the big task of rehousing America after the war is finally won.

II. First Five-Year Housing Projection

To you, however, the evident need for housing is only part of the problem. Your greatest interests, and ours, rest in just how many housing units will actually be built.

A careful check of data compiled by the country's leading authorities indicates that one should expect housing construction to develop on the following approximate schedule:

(1) First year, 350,000 to 400,000 units.
(2) Second year, 500,000 to 600,000 units.
(3) Third year, 700,000 to 800,000 units.
(4) Fourth year, 900,000 units.
(5) Fifth year, 1,000,000 units or more.

These figures are reasonable and within the ability of the housing industry to accomplish and the public to absorb.

When the war is over, fifteen years will have elapsed since there has been any important amount of modernization or repair. A crying need for fundamental repairs and a tremendous demand for modernization of our present housing structures have existed for many years. During the transition period from war to peace, repair and modernization should be the major factor in our housing efforts. With proper stimulation, the number of dollars that will be spent in the first one or two years immediately following the war for modernization and repair will not only equal, but will probably exceed, by from 25 to 50 per cent, the number of dollars spent on new housing construction.

New housing construction of the magnitude just projected will require large volumes of permanent public works, such as streets, sewers, water systems, sewerage-disposal plants, playgrounds, schools, and commercial and public buildings. This volume is estimated to be at least equal to the number of dollars invested in new housing. A great deal of this "heavy construction" should take place in advance of actual housing construction.

The actual potential of the three phases of the total housing market, the new, the modernization, and the permanent public works and commercial buildings, represents a major opportunity for the construction industry.

The success of each branch industry's participation in postwar housing will depend upon just how well we promote our ware, upon our close cooperation with the housing industry, and upon how well we do our jobs.

III. Electrical Home of Tomorrow

To the electrical industry and its allied interests, which include our ceramic friends, housing, commercial buildings, and the home have long been an important market. Today, we stand upon the threshold when it will become an even more important market. Every signpost points to the Home of 194X as a completely electrical home.

(1) Electrical energy has been a major factor in the vast and amazing production of war goods and materials. Its production has been greatly expanded. As we turn from war to peace, vast amounts of energy will be available to play a major part in raising the standards of American living.

(2) Never in history has man had as flexible a source of power and energy as that of electricity.

(3) The history of electrical rate structures over the past two decades has been one of greater service and lower cost to the ultimate consumer. Electrical power is the least expensive of all "essential household services."

Yes, the home of the late forties and fifties can be completely electrical!

For many years, utilities and the electrical manufacturers have promoted the complete electric kitchen. This promotion has been a success. Thousands of complete installations are now in use, to the gratification of their owners.

This technique of using a complete room with the electrical installations in their proper setting, a part of the whole room, with all of its beauty, its comfort, its convenience effectively displayed, and known as ensemble selling, is adaptable not only to the kitchen, but to the laundry, the utility room, and yes, even to living rooms, bedrooms, and baths. In fact, ensemble promotion will apply to the entire home, the complete living unit in 194X.

The complete kitchen has in the past been considered to consist of a range and refrigerator, with possibly a dishwasher and disposal unit. Too little emphasis has been placed upon the better location and greater use of the roaster, coffee maker, toaster, electric mixer, waffle maker, kitchen ventilating fan, and the radio, the small items, which if convenient and accessible for best use, would add to its convenience.

Again, the modern laundry in the home of tomorrow will consist of an automatic cycle washer, a drier, an ironer, and a water heater.

The advent of the Precipitron, as a practical home device that assures an air supply free from dust and with low bacteria count, and the Home Freeze Locker, when added to the heating and cooling system, brings to the utility room a new importance.

Visualize, if you will, the value of complete room ensemble promotions in the consumer goods postwar program.

IV. Problems and Contributions

But how can this great need potential be converted into actual houses? What is the major problem upon which the housing industry must focus its attention, that is so essential to the proper conversion of this huge need market into actual fact? What single contribution will pinnacle to greater importance over all others?

The problems of the housing industry in approaching a market of the magnitude previously outlined are many,

and the problems of the industry are the problems of the material and equipment producers. It is essential, however, that all of these problems be carefully analyzed in a search for the major problem and to establish the proper evaluation of each factor to the major problem. Once established, it is then necessary for the industry to raise its sights and focus them on the major problem, rather than upon the many partial problems that far too often are overemphasized as to their importance.

Will it be reconversion? No! As great as this problem is with all of its ramifications from materials to retraining of personnel, from production to distribution, it actually is only a part of the problem.

At the conclusion of the war, it will be essential that industry reconvert in the shortest possible period and with a minimum of unemployment. This means that the consumer goods manufacturers must get back into the production of the things that they were making when the clouds of war descended. The tools, the techniques, the materials, and the production lines can be more easily converted to 1942 products than to wait for new tools, new techniques, and new materials that entirely new products would require. It is, therefore, only sound, sensible thinking to anticipate that most equipment and materials will be the same or similar to those with which we built in 1942. To be sure, these may carry a new dress, but fundamentally, 1942 products should be anticipated for the immediate postwar period.

Please do not misunderstand nor classify these remarks as reactionary. Many of the elements and materials and products which we have seen displayed across the pages of our forward-thinking publications and have heard expounded from the stage and press as "Items of Tomorrow" will eventually become a fact.

Product and equipment history, however, has been one of organized improvement year after year, through research and development, step by step. New materials require new techniques, new machinery, and reasonable periods of testing before the reputable manufacturer is prepared to place them on the market for consumer use, and this evolutionary process applies to housing as well. You may be sure, however, that the period immediately following the war will be one of greatly accelerated development of all products and materials, both old and new.

* * *

Will it be the rebuilding, the revamping of distribution? Again, the answer must be no. Any changes in this important field will take place in an orderly fashion, step by step, in an evolutionary manner, over a period of years, in tune with other developments.

* * *

Will it be the development of new materials, new equipment, supplies and appliances? Important as the contribution of new materials and new products will be, it is only one of the contributing factors. Here one should anticipate the continuation of an evolutionary process that has been going on ever since the development of water power inspired man to greater mechanical developments, ever since the Yankee peddler realized that in the development of new items, the improvement to his existing meager lines of early implements, lay a golden opportunity. Year after year, decade after decade, century after century, this evolutionary process has consistently brought new or improved commodities to our door. Through boom periods and depressions, through periods of peace and periods of war, history establishes that this process of new developments, new materials, and new products has been continuous but that it has always been accelerated by the necessities of war. Necessity has been, and always will be, the "mother of invention."

And World War II and the years that follow will be no exception to this time-honored fundamental. No! Our answer does not rest within the process of invention and development alone. Actually, as a nation, only partial use has been made of the vast array of products, materials, equipment, and techniques in existence in 1941 in the housing field. The public accepts new items, new things, and major changes slowly. Proper mind-conditioning of the public to new commodities and new techniques, changes with which they are not familiar, through carefully planned educational programs, is a "must" to the goal of public acceptance, the true measure of success.

* * *

Again, is it a better financing plan, lower interest rates, longer terms of amortization?

Much has been accomplished in this field; sound progress has been made. Further progress should be anticipated, but here again, careful analysis indicates that this is not the major problem.

As vital and as complex as the foregoing major questions are, they are only part of the one major problem of the producers of housing materials and equipment. Savings in cash, Government bonds and credit potential in the hands of the consuming public, will be at an all-time high at the conclusion of the war. Never before has the consumer purchasing power reached such astronomical proportions. Never in history has such a pent-up desire to buy consumer capital goods and luxuries spiraled to such heights.

Here are two important elements of free enterprise, the desire to purchase supported by the power to purchase in the form of cash or credit straining at the leash, waiting for the relinquishment and removal of necessary wartime limitation orders when the lifeblood of free enterprise, fair competition, can again flow through the veins of private industry, when the normal flow of capital and consumer goods will bring a higher standard of living not only to America but to the world.

Here also lies the housing industry's greatest problem. As with all industry, fair competition is the lifeblood of the housing industry, not competition within the industry itself but with other industries that will vie with might and main for a larger share of the consumer dollar.

The ability of the housing industry to compete successfully with the automobile, the fur coat, jewelry, delayed vacations, etc., for a fair share of the consumer dollar is its greatest problem, and in its solution rests the industry's greatest contributions to society, social and economic. Its solution is a "must" if American housing is to hold its own with the balance of our living economy.

All of the questions raised earlier in this presentation and many others are contributing elements to this problem.

Each must be solved within the framework of the major problem. Many of you may ask, "What is 'housing,' in terms of meeting this competition?"

Far too often housing is considered as shelter only. To many, it is structure and a minimum space of land; to others, it is structure, land, and certain specific equipment. All of these conceptions fall far short of the broad scope of the major problem.

Actually, housing is the shelter for the heart of the family unit, the home, and the Home of 194X must be a complete living unit to meet competitive requirements.

It is therefore only sound, sensible thinking for the industry to meet its major problem by developing a complete package of living with ample land and trees to meet its occupants' social, economic, and artistic requirements, with a structure that gives maximum protection from the elements at minimum maintenance expense and maximum architectural appeal, with sufficient equipment to insure heat, light, sanitation, cooking, food preservation, and laundry facilities at minimum operating costs, located on streets free from through traffic and convenient to schools, churches, theaters, parks, stores, commercial buildings, and easily accessible to industry.

Again, industry must develop a series of living packages for the various economic and social levels that can be merchandised at a fair profit and at a price within the means of each major income bracket. A fair rental will amortize the mortgage and maintain the investment at maximum satisfaction to its occupants. It is this "living package" that will be a real competitor for a fair share of the consumer dollar. It is the cooperative part which building material and equipment producers will play in developing this competitive package that will form the basis of their greatest contribution.

V. Your Job

Some of you will undoubtedly feel that now is not the time for action; others will feel that the task of solving this major problem is far too great. Actually, however, the time is far too short to set the stage, train the actors, and develop the plan to do the job, to meet the challenge of this major problem, to produce a really competitive package.

A review of the fundamentals of this major problem suggests the following program, recognizing two important facts, viz., that (1) housing is highly competitive within the industry and (2) housing is a local industry.

(1) Industry Relationship

The immediate establishment in each and every community in this fair land of a cooperative relationship between the various branches and elements of the entire housing industry is of great importance. This includes the builder, the architect, the engineer, the utilities, the banker, the building and loan associations, the producer and distributor of supplies, materials, and equipment, the federal housing authorities, and your city planning and technical organizations that control conditions and public works.

It will require strong, capable, and cooperative leadership to organize all the branches of the housing industry in your various communities into an effective, flexible, coordinated group. Think, if you will, of the leadership that your representatives can bring to your community groups through your years of experience in developing, promoting, and executing well-rounded, coordinated programs, both technical and commercial. Opportunity is knocking at your door!

(2) Technical Cooperation

The local need for an engineering and technical program directed at the builder, the architect, the engineer, and the financier to insure sound specifications, fair and adequate inspections, and equitable and all-inclusive appraisals, is essential.

(3) Consumer Development

A consumer educational program is of vital importance. The necessity of educating "Mrs. Homemaker" of the advantages to her budget that can be gleaned by purchasing homes having equipment with a proved record of long life and low operating cost cannot be overemphasized. It is a definite responsibility of the manufacturers and their distributors who supply the mechanical equipment of the home to keep continually before the home builder and the potential homeowners the fact that low original cost of equipment often means high operating and maintenance expense. The purchasers of low-cost homes can ill-afford to invest their dollars in homes equipped with inefficient devices. Home ownership has suffered much in the past because of this fact.

VI. Plan Today

The lapse of time necessary to develop plans, specifications, and financing for permanent essential public works necessary to a complete postwar housing program requires from six to eighteen months. Not only should immediate steps be taken in your respective communities to see that planning through the blueprint and specification stage, but arrangements for the necessary financing are of equal importance. This is a "must" against undue unemployment during the reconversion period.

Again this planning should also be applied to housing. Builders and contractors should be encouraged to obtain land, develop project plans, obtain approval for street locations and grades, make arrangements for utility facilities, and care for the necessary financing to insure that housing projects may be started as soon as Government restrictions permit.

To develop, organize, and promote a program of the magnitude outlined will require a strong, well-organized, local, state, and national housing industry. Through the facilities of the United States Chamber of Commerce and the various trade associations of the respective industrial groups comprising the construction and housing industry, a national program is in the process of development, and you and your industry, through your trade associations and the Producers' Council, are represented in the national effort..

Some of you are already members of local organizations that are working on programs. To you who are in this fortunate position, we suggest that you accelerate your efforts; and to you who have not as yet put your shoulder to the wheel to meet this important opportunity, may we suggest that you do so at an early date.

Picture, if you will, the opportunity which now affords itself to you as individuals, as manufacturers, to play a most important part in converting the need for postwar housing into actual American homes, with all of the advantages, all of the conveniences, and all of the comforts that the home of 194X can bring to its occupants. Visualize your opportunity to develop cooperative leadership within the housing industry of the communities in which you serve. Put into action a sound well-developed program, the outlines of which are now reasonably clear, and through this cooperative effort insure better American homes, a better, sounder democracy, in the postwar period.

CHEMISTRY IN THE POSTWAR PERIOD*

By Edward R. Weidlein†

Often in the past fifty years a person with a new or better idea of importance has created an organization, usually corporate in form, to facilitate its industrial application. Frequently such a company has been so effective that it has loomed above its creator. We have an excellent example in the development of aluminum, for whose basic operations Charles M. Hall had the original idea. Other notable illustrations are Edison in the electrical field, Westinghouse in electricity and transportation, Ford in the automotive industry, Bell in telephony, Eastman in photography, Baekeland in synthetic resin manufacture, and Dow in chemicals. Conditions were extremely favorable during these men's lives to enable them to make these great contributions to humanity. It is plainly evident that the use of these inventions has lightened the work of everyone and has brought more satisfaction to all.

During the past twenty-five years, American industrialists have had leadership in employing highly trained chemists and other scientists in original researches with a view to new discoveries or to useful improvements. Industrial research, in fact, is no longer an isolated activity. The ceramic, metallurgical, chemical, plastics, synthetic textile fiber, illumination, telephone, radio, automobile, and aviation industries have been built up scientifically from their foundational inventions to essential places in our country during this period. It is significant that the time lag in the development of these industries has been greatly reduced by a better understanding of teamwork among the pure science research worker, the industrial scientist, and the industrialist. In no branch of industry, however, is scientific research at the peak of its power.

In bringing these industries thus far along, epoch-making changes, which seem to come speedily, are actually the results of years of patient research. It requires generally from ten to twenty-five years to apply effectually basic scientific principles to the development of a needed new industry. Present living conditions are to some extent awakening people to a realization of the value of these scientific accomplishments, which have made for a higher standard of living in this country than in any other. Such achievements have likewise brought to the attention of Americans the dependence of our very existence upon the research scientist and engineer.

In the present national emergency, the Federal Government has turned necessarily to the great industrial organizations maintaining large research staffs of scientists and engineers to help solve the many problems vital to the winning of this war. We can easily visualize the weak position America would be in today if it were not for the extensive researches and developments carried out during the past twenty-five years. This work has brought industries to such a high stage of efficient productivity that they could meet many of the innumerable requests made for special types of products to meet our war effort. These researches and developments are not only enabling the supply of the necessary raw materials, but they have so greatly reduced the cost of production that the American people are being saved large sums of money. We do not figure cost in a war, but nevertheless if it had not been for scientific alertness and progress we would not today have the supremacy of the air, for example. Likewise, many more millions of dollars in war bonds would be required to support the war effort.

The petroleum industry deserves a great deal of recognition along this line, particularly for the development of aviation gasoline. The technical advances in this field seem phenomenal when you consider that just a few years ago aviation gasoline cost about $30 a gallon whereas today it is being produced at a price a little above that of ordinary gasoline.

The fruits of research and invention are indeed needed for victory. It is not in order at this time to reveal detailed information regarding the innumerable contributions of pure as well as applied science to our present war program. Such a feat as radar, which has recently been partially explained to the public, is an excellent instance of the value of fundamental research conducted in the field of electronics for a period of many years and then advanced to the point where, by bringing in additional scientific personnel, a device has been quickly developed to a high degree of usefulness in combat warfare. Electronic appliances likewise have been just as effectively used behind the lines in controlling basic chemical engineering processes and are finding untold employment in many fields.

We are carrying on an intensive investigation at the Mellon Institute on the use of ceramic materials for radio and radar work. In fact, many recent developments at the Institute in the field of ceramics are finding valuable application in the war effort, especially in the high-temperature field.

Thorough research and development have been done in the field of explosives and on all the various raw materials

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entering into their production. Two of the basic ingredients, toluene and ammonia, were extensively studied continuously from World War I, and the companies sustaining this work were prepared to start at once the large-scale production of synthetic toluene and ammonia, even before Pearl Harbor. Arrangements were made in the fall of 1940 to expand the processes of manufacture and as a result every demand of the explosives industry has been fully met.

New textiles have not only increased our war efficiency, but if the researches carried out in this field had been neglected during the thirties we would today have found it very difficult to fill many of our needs which in peacetime had been provided in the form of Japanese silk. It has been necessary to comply with the demands of war and to make these textile fibers resistant to fire, mold, insects, and water.

Some of the many other new advances during the emergency are an electrolytic procedure for tin plating, which saves 60 to 75 per cent of the metal; a radio frequency sewing machine for welding rubber; high-speed gas turbines for commercial and cargo planes; and, most important of all, our synthetic rubber industry.

So much has been told about the synthetic rubber industry that I only wish to emphasize the fact that the problem of manufacturing synthetic rubber in this country in sufficient quantity to meet our national needs is in the minds and hands of American chemists and engineers who have gained their specialized knowledge and skill through years of research and through the expenditure of several million dollars by the American rubber, chemical, and petroleum industries. All the research undertaken by these scientists is now made available to the American people by a complete pooling of all pertinent information. The bringing together of all these scientific particulars, along with the financial support of the Government, has reduced the ordinary time factor of from ten to twenty-five years to a period of two years. To meet our rubber demands, this concentrated, concerted action was a case of absolute necessity. But these plants and processes will be constantly changing and improving, which, in the normal period of development, will lead eventually to a well-established synthetic rubber industry whose output will compete favorably with the natural product. "Synthetic rubber" is actually a misnomer, as what really are being developed are new elastomers. They are novel types of raw materials, and the possibilities of betterment and growth in this field for the future are practically unlimited.

The pressure of this war is compressing into the space of a few months the realization of developments that might have taken us half a century to attain had it not been for the forced pace and the teamwork. Many changes in methods, processes, and uses of materials within the industries are taking place at present. These alterations and improvements are largely behind the scenes so far as the public is concerned, but proper postwar planning will convert them into useful peacetime procedures and products, with noticeable increases in quality, quantity, and variety, at reduced costs. More important in future outlook, we are opening up new basic scientific information, which, if properly supported and utilized, will keep us industrially busy for a great many years to come. It is generally recognized that we are no longer able to thrive on the unrestricted exploitation of the gifts of nature—that, to utilize our resources more intelligently and effectively, scientific research on an increasing scale is necessary.

The amount of inventing, of original and creative thought, leading to the public good, which is taking place in the great industrial research laboratories all over the country today, is so great and so obvious, so apparent everywhere we turn in our daily lives, that we need not defend it here; but we do need to defend it wherever a destructive and negative viewpoint is recognized. The surface-patterns of technology show plainly that scientific research and development are the commanding major strands upon which the whole fabric of successful industry is woven.

The "flash of genius" mentioned in a recent ruling of the United States Supreme Court can occur to a scientist in the course of a laborious research project in a large industrial laboratory, as well as to a man alone in a shop in his basement. The "flash of genius" should not be dimmed in the judicial mind by the shadow of the corporation.

Eli Whitney, one of the country's most famous inventors, was an acknowledged genius, and the cotton gin was a creation of genius, but it was no flash. After Mrs. Greene had suggested to him in Savannah that a fortune awaited the man who developed a device for freeing the lint from cotton seed, he spent the entire winter secluded in an improvised workshop before the first machine was brought forth; and even then the device was not practical until Mrs. Greene, using her clothesbrush to free the lint collected on the cylinder, gave Whitney the idea for a doffing brush that rendered the apparatus successful.

Nylon, which was certainly the creation of a genius, was nevertheless brought into being by Carothers through a comprehensive and lengthy series of experiments deriving from a market demand for a fiber that would dye like wool and maintaining a continuity of thought which has been traced all the way back to 1734 when Reaumur wrote, "Silk is only a liquid gum which has been dried; could we not make silk ourselves with gums and resins?" .

The aliphatic organic chemical industry has been taking its place among the largest of the chemical industries during the past fifteen years. The foundation for this industry was originally established about 1795, but it did not receive intensive research until 1914; it required eleven years to establish the first commercial plant, and the industry was not actually well started on the road to success until 1929. This particular industry is now a real force in modern civilization and vital to our war effort. Its products were the first to be placed under mandatory priority, even before Pearl Harbor, and it has contributed more to the present healthy state of the synthetic rubber program than any other single industry. Of interest is the fact that the plastics industry was established just about the time research was started in this field and yet the greatest advances have taken place in the development of new plastics since 1929.

The most valuable type of research, from an economic standpoint, is related to the utilization of certain of nature's raw products, such as coal, natural gas, petroleum, cotton, wood, corn, etc., as starting materials for

making commercially new and valuable commodities by synthetic methods. Modern chemistry has developed thousands of useful products from these materials and has created from them industries that are essential in our present-day civilization, and yet we do not even know the chemical structure of the majority of these raw materials. This example shows the primitive state of some of our knowledge and indicates what remains to be learned in vital fields.

The control of a natural product is likewise being met through synthesis of the material. This phase of our scientific development is merely at the threshold of its service to mankind. It is the one means for man's protection when natural supplies fall short. We have had recent illustrations in the production of synthetic vitamins and drugs. Chemists are constantly at work attempting to devise practical methods of preparing alkaloids, essential oils, resins and waxes, and other important constituents of plants. These researches will some day make it possible to duplicate or to excel most of the important vegetal chemicals. Even at present not a few naturally occurring chemicals are being manufactured.

Throughout the history of the United States industrial expansion has been the major creator of new employment opportunities. The advancement of technology has given rise to new industries, enlarged old ones, and generated demands for increasing numbers of workers in production, distribution, service, and allied occupations. The potentialities for the same type of progress in the future are greater than any that ever existed in the past. One of the most important tasks is the stimulation of scientific research to gain increased knowledge of the materials and forces of nature so that this information can be used through ingenuity and skill to create new and improved products for industry, to find industrial applications for farm products, and to handle more efficiently our natural resources. Upon the return of millions of men to civilian life from our armed forces—men who will have to become acquainted with the new and useful creations of our research laboratories—a better understanding of the value of scientific research should ensue. These men should be able, with the training and experience they are now obtaining, and with our encouragement, to add the stimulus that further research will need. Like scientists, they will know that new frontiers must be faced with as little handicap as possible.

THE EXCAVATION OF HAN TOMBS*

By Meng-chang Ling

I. Introduction

To extend the National Bureau of Industrial Research in China, more land was bought and more factories were erected in the suburbs of Chungking, the wartime capital of China. There is a place where the sun rises from the grassy hills and sinks beyond the woody mountains. It is backed with good cornfields and faces a bending river. By its side is a continuously flowing stream with water crawling over rocks down to the river. It is this piece of land that was bought for the extensions, and it is also this piece of land which the people in the Han dynasty two thousand years ago selected for burying their dead.

Most things will not last through two thousand years. The human body and its costume were destroyed long ago, the wooden coffin has decayed, and most of the metals have rusted away. All that remains are the earthen or ceramic articles, such as jade, brick, clay images, and other pottery, which reveal the habits and customs, the art and architecture, and many other things concerning the social, economic, and political affairs of the time.

While excavating the Han tombs, one of the most striking traits to be disclosed was the strict observance of filial piety of these people. They chose the best place with good scenery for burial grounds. They built strong and beautiful tombs with brick of different patterns. They brought dogs to guard the place and dancers, musicians, and various utensils filled with fragrant wines and delicious food to entertain the spirits of their parents. In other words, they tried their best to make their parents king and queen of the tombs, even though in so doing they might have to suffer themselves.

Looking backward into the earlier history of China, one discovers that many good works which have been done by the people of the later dynasties originated from this filial characteristic. For example, in the Han dynasty practically all city walls were built of mud. Though people knew thoroughly how to protect the dead with strong brick walls, they failed to protect themselves with the same material. Several hundred years passed before people realized this point and began to build their city walls with the same strong brick.

As was mentioned previously, there are many aspects which can be studied from old tombs like these. In this paper, more attention will be paid to the people's habits and customs and other things connected with ceramics.

II. General Description of the Tombs

The Han tombs were grouped together in series. There were five in a row about one meter apart. They all faced south and were about the same dimensions. The tops of the tombs were approximately $1^1/_2$ feet below the surface. The tombs were torn down, except in two cases where the entrance arches which happened to be under the edge of the field were intact. The entrance at the front was lower and narrower than the rear. There was no memorial stone. The entire entrance was sealed up with brick. All the tombs were filled with mud which likely had leaked through cracks. The collapse of the arch might also have caused the mud to rush in and destroy the settings of the tomb. In one case, the tomb was not built of brick but of plain sandstone blocks one foot in cross section and from 3 to $4^1/_2$ feet long. This particular tomb was about 4 meters away from the other tombs. A horse, a dog, and several clay images were found in good shape. The top of the tomb was already gone. It is hard to say what kind of materials the arch was made of, as no fallen stone or brick was found inside the tomb.

* Received November 3, 1943.

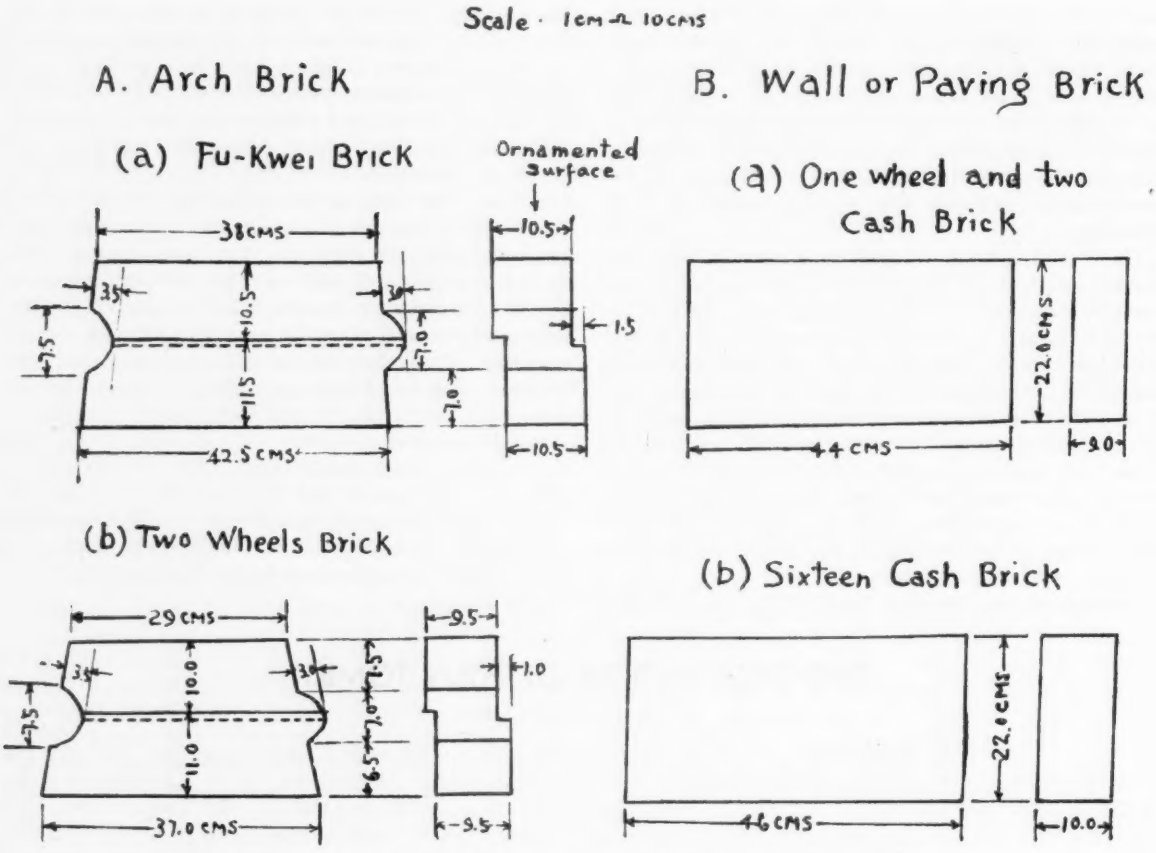

FIG. 1.—The Han brick. In all cases, the design is impressed on the top surface.

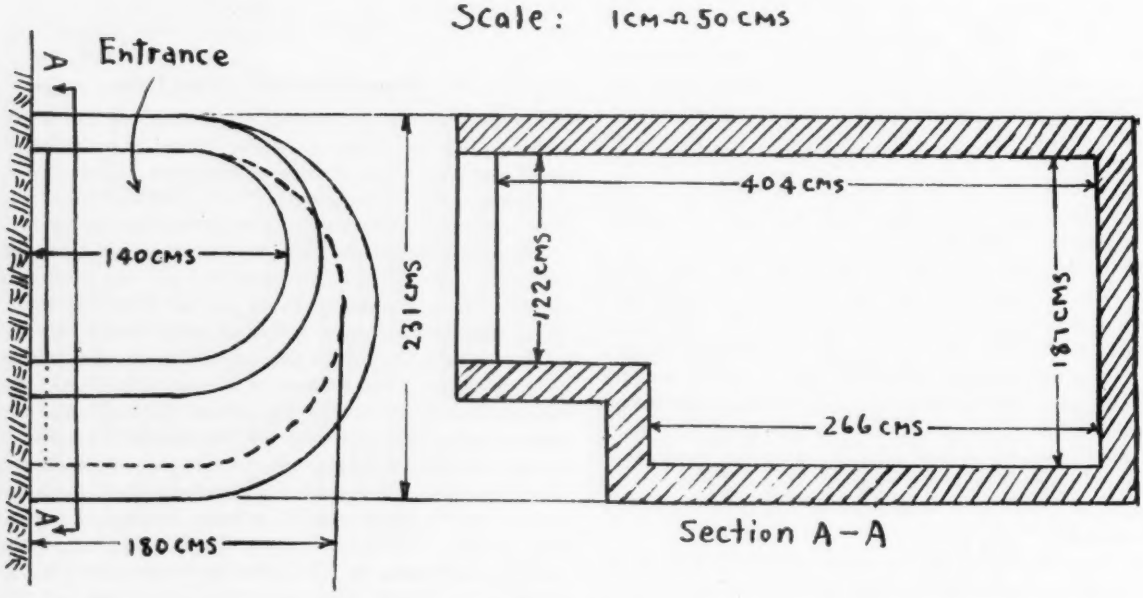

FIG. 2.—The Han tomb.

The blue brick (Fig. 1) which was used to build the tombs is about 22 cm. wide, 44 cm. long, and 10 cm. thick and weighs 40 pounds. Each brick has a design on one side. Five patterns were found altogether: three of wall and paving brick and two of arch brick. The tomb floor was very level. One of the laborers remarked: "Let's sleep here for the night; our beds are not so smooth and even as this." Under this brick floor was a layer of sand which had been carefully leveled and well pounded.

The wall brick (Fig. 1 (*B*)) was laid flat, and its pattern faced inward. The three different patterns (sixteen cash, one wheel and two cash, and diamond ring) were arranged so that the whole wall was very beautiful.

The arch brick has two patterns. One of them has two Chinese characters on it: Fu (richness) and Kwei (high position). The other is decorated with two wheels and diamonds and is so designed that one end has a convex part and the other end a concave part (Fig. 1 (*A*)). These parts connect one brick with the other to form a strong arch. No lime or other cementing material was used in building the tombs. They were united by the principle of mass and gravitation force and by interlocking action.

There were two types of entrances, viz., the circular (Fig. 2) and the pointed. In the circular type, several hairpins were found; no such pins were in the other type. This may show that the circular type is a female tomb, whereas the pointed type is not.

Some copper coins of "Wu-chu" and a few pieces of broken iron rings were also found. There was no coffin in the tomb, but numerous carbonized wooden pieces were scattered here and there which probably came from the integration of a wooden coffin. No skeleton or bone was found. The tombs may have been robbed before and the dead taken away with many other valuable things.

Unfortunately, there was no inscription on any of the excavated articles which could be used to trace back to the date when the dead were buried. The "Wu-chu" coin, issued in the years A.D. 124 to 617, had been used for nearly five centuries; its presence therefore proves nothing definite. But the brick, the structure of the tombs, the clay images, horses, chickens, and other pottery were undoubtedly typical examples of the Han dynasty.

On a cave-tomb very near to these tombs were inscribed two dates in two rows: A.D. 175 and 178. These tombs might have been built before or shortly after this time.

Four years ago, two stone coffins, together with clay images, chickens, and horses similar to those which have been found here, were excavated on the opposite side of the river. The stone coffins were engraved with beautiful patterns. One pattern, of human faces and snake bodies with their tails united at the ends, symbolizes one of the first kings of China, Fu-si, and his wife Nu-au. A similar design was also found on a memorial stone pillar about fifty meters away from these tombs. In the same tomb, two brass mirrors were also found. One of them is inscribed with eight characters which have been identified by Professors Shang and Ching to be of Han dynasty in the year A.D. 105.

From the preceding evidences, it is reasonable to assume that the tombs were built in the second century.

III. Evacuated Articles

All articles which are buried with the dead in the tombs are called "Ming-chi" in Chinese. As mentioned previously, the tombs had been looted and were full of mud, so the good articles had been taken away and the remaining pieces were smashed to bits. It is pitiful to be unable to see the original settings of the tombs. Fortunately, there are several tombs, and objects missing in one tomb may be found in the other.

The excavated articles may be classified into glazed and unglazed, according to the surface ornamentation. Practically all sacrificial vessels were glazed and were made impervious to liquid so that the material or food could be well preserved.

From a joint collection of all the articles from the tombs, the following list of earthen articles is believed to be those originally set in a tomb.

(1) Unglazed Articles

Two dogs: One dog was keeping the door at the front and the other was guarding the corpse in the rear. They are 25 cm. long and 20 cm. high and are tied with belts, one around the neck and the other around the chest. Most of them were standing but some were sitting. Such dogs must have been presented to the Han emperor from abroad. They were thought to be especially good for guarding purposes.

Two horses: The horses were found frequently with the dogs. They are much bigger than the dogs, with heights varying from 45 to 60 cm. One horse which had been found in perfect shape was crushed to pieces shortly after the excavation. It was standing on three feet with one front foot lifted and its tail curving upward. Its entire expression was vividly copied from a living horse.

Sixteen clay images: The clay images were different in size and in costume. Most of them were found in pairs on both sides of the entrance. Among them were doorkeepers, waiters, musicians, dancers, and friends; their heights varied from 17 to 35 cm.

One house: The house is about 30 cm. long, 9 cm. wide, and 45 cm. high. Because it was so high and slender, none was found in good shape. It has a plain roof and probably two or three stories. It was set near the wall at the inner part of the tomb.

One rice steamer: The rice steamer is called "Tseng" in Chinese. It was made of blue pottery which differed from the more abundant red pottery. It has six holes in the bottom and is 21 cm. high; the bottom and the top diameters are 15 and 32 cm., respectively.

One table: The table is 25 cm. wide and 43 cm. long with a 1-cm. wide rim 1 cm. deep. It differs from an ordinary tray in that it is supported by four feet 5 cm. high. Such a design is called "An" in Chinese. One "An" in two pieces was excavated at the entrance way of a tomb.

Two chickens: A cock and a hen in pair were found at the front part of the entrance way. They are about 12 cm. high and 18 cm. long.

One pig: The pig is 10 cm. high and 25 cm. long. It is too small compared with the size of a dog. Perhaps it was set upon the table with the chickens and others as sacrificial food for the dead.

(2) Glazed Articles

Six wine cups: The wine cups are called "Wu-shang" in Chinese. They are shallow egg-shaped cups, each with

two handles spread out like wings on the rim. They are glazed inside and have a capacity of 40 cc.

Four small pots: Two of the pots are smaller than the others. Each has a volume of 850 cc., is 12 cm. high, and has a flared neck 3 cm. high. Right under the neck it is decorated with two lines 2 cm. apart. The two bigger pots double the others in capacity. They are without necks and are decorated only with a single line 2 cm. away from the rim. These pots were probably used to contain wines and sauces.

One large pot: The pot has a neck 6 cm. high which is flared at the top with a mouth diameter of 21 cm. The total height is 24 cm. It is decorated with four lines, one under the neck, two in the middle of the pot separated by a distance of 2 cm., and one added next to the third. Two handles are placed at two symmetrical spots between the two middle lines. This pot seems to be the lower part of the rice steamer. The bottom of the "Tseng" fits perfectly into this pot.

One oil lamp: The top dish of the lamp is 10 cm. in diameter and 2 cm. deep. It is about 14 cm. high.

One "Chung": The "Chung" is a very beautiful vessel decorated with lines and the figure of "Tao Ti" with a ring in its mouth. It was noted as being a great gormandizing beast in ancient days and was used as a symbol for driving away evils. The vessel is glazed with glittering silvery glaze. It was a volumetric measure with a capacity of 4.5 liters.

One "Yiu": The "Yiu" is similar to a water bucket and has a handle decorated like the roof of a house. It was probably used to contain special food for the dead.

Two or more breads: The breads have the shape of a hemisphere with many small round protrusions on the surface. They were probably imitations of bread or they might have been parts of a vessel.

Coins of "Wu-chu" and rusted iron rings were also found in every tomb. The rings might be parts of a sword.

IV. Formation of the Clay Articles

From a study of the excavated clay articles one can easily realize that the art of pottery had been highly developed in the Han dynasty. Most methods used now were practiced two thousand years ago. The following typical methods were used:

(*1*) *Throwing:* The round ware, such as pots, lamps, "Chung," and "Yiu," were formed by throwing on a potter's wheel.

(*2*) *Pressing:* Many irregular or square shapes, such as animals, images, house, and brick, were formed by pressing into clay or wooden molds.

(*3*) *Pasting:* The large articles were formed by parts and pasted together with clay slip. These parts might be formed by pressing, such as horses, dogs, pigs, and chickens, or they might be formed by both pressing and throwing, such as "Yiu" and the handled pot.

(*4*) *Glazing:* The Han people were fully aware of the purposes of glaze. The glaze was probably applied to the green ware with a thicker layer on the upper half. During the firing, part of the glaze flowed down to the bottom.

(*5*) *Firing:* Firing, an important method of turning clay into a more resistant and valuable pottery, was fully understood by the Han people. From the fusion temperature of the glaze, it is estimated that the firing temperature of the red glazed pottery seldom exceeded 900°C. The firing temperature of brick was perhaps 200°C. higher than the red pottery. Because of the size of the brick, it must be fired in the kiln for a long time. Bluing of brick by the action of steam upon finely divided carbon was fully exercised by the Han people.

The analyses of different pottery bodies are given in Table I.

TABLE I

ANALYSES OF POTTERY BODIES

	Blue brick	Blue pottery	Red pottery
Ignition loss	0.29	4.56	1.95
SiO_2	71.77	63.35	67.51
Al_2O_3	14.62	16.81	14.88
Fe_2O_3	7.64	6.99	7.08
CaO	0.64	1.54	2.37
MgO	1.84	0.86	2.45
Undetermined	3.20	3.85	3.76

From the analyses, it can be assumed that plastic surface clay was used as raw material. The blue and red colors were formed under reducing and oxidizing firing conditions, respectively.

V. The Glaze

The glazes vary on these excavated articles. A close study reveals that they were more or less of the same base glaze. The chemical analysis and the empirical and theoretical batch formulas of the glaze are given as follows:

Chemical Analysis

	(%)
SiO_2	60.14
Al_2O_3	Trace
Fe_2O_3	1.32
CaO	11.88
MgO	3.66
PbO	23.00
Total	100.01

Empirical Batch Formula

$$\left.\begin{matrix} 0.50 & CaO \\ 0.24 & PbO \\ 0.22 & MgO \\ 0.04 & FeO \end{matrix}\right\} \quad 2.37 \quad SiO_2$$ (fusion temperature of glaze is about 900° C.)

Theoretical Batch Formula

	(%)
Litharge	20.0
Quartz	53.1
Dolomite	15.2
Limestone	10.5
Hematite	1.2

The batch formula was calculated from the chemical analysis with pure ingredients. Pure compounds, of course, were not available at the time, and a high-magnesia limestone containing 20 to 30% of magnesium carbonate was likely used instead of dolomite and limestone. The iron oxide was not purposely added to the batch. It could easily be present as impurity in quartz. The following batch formula, therefore, seems to be more reasonable:

	(%)
Quartz	50
Litharge	20–25
Impure limestone	25–30

The glaze has the typical yellow color of iron. A green tint may also be found occasionally which was caused by the impurity of copper oxide. When the glaze is thinly applied, it is yellow and semitransparent, though crazed badly. When it is thickly applied, it is opaque with sparkling silvery luster. This opaque glaze is partly dissolved in acid with an evolution of gas. It amounts to 6.74% of its total weight. The opacity and the silvery luster were probably due to the crystallization of the glaze through a long period of weathering. This glaze is very beautiful and is locally called "Eng-pien" (silver flake). Except for the luster, it has no actual connection with silver.

VI. Conclusion

The filial piety to parents is one of the most striking characteristics of the Chinese people. It was strictly exercised thousands of years ago by people of all ranks. One scholar estimated that two-thirds of all the good things presented to the Han emperor were used for worshipping ancestors and tombs and only one-third for entertaining guests. On one occasion, the tombs were badly looted by rebellions, and the looters were unable to take away even half of the contents, although their hands were full. Such tombs were packed with jewelry, coins, food, wines, tableware, kitchen utensils, musical and military instruments, fowls, beasts, fish, carts, and images of many other objects. The ordinary tombs of common people, of course, were much simpler. Such people could not afford to have everything real, so they substituted with imitations made of clay.

The art of pottery had been highly developed in the Han dynasty. At that time, porcelain was not yet made; the people knew only how to make ware out of ordinary surface clay. A more complicated batch was prepared for the glaze. It is actually a low-fusion glass which crazed badly and weathered readily. Weathering formed flaky, white crystals and thus opacified the glaze. It has a silvery luster and is very pretty from the artistic point of view.

The Han brick is unique. One collection includes more than one hundred different brick patterns. Such designs are artistic and full of meanings. The shape of the arch brick is also characteristic of the time. A good engineer is required to calculate and fix the dimensions shown in Fig. 1 (*A*). The technique in manufacturing such brick was very skillful. Even now, it is difficult to imitate these brick.

The author heartily welcomes those who are willing to investigate further the other problems of these old tombs.

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EFFECT OF DEFLOCCULENTS ON PHYSICAL PROPERTIES OF POTTERY PLASTER MOLDS*

By L. E. Cunningham and E. W. Duffy

Abstract

A study of several chemicals employed as deflocculents in clay slips revealed the variable effect of such deflocculents on the physical properties of plaster molds. The effect of several commonly used deflocculents upon mold surface qualities, strength, hardness, weight change, absorption, drying, and rate of calcination is discussed.

I. Introduction

The life and properties of plaster molds used for shaping clay bodies by the slip-casting process are affected, generally adversely, by the soluble deflocculents commonly employed in the clay slips. All deflocculents in common use react chemically with set gypsum ($CaSO_4 \cdot 2H_2O$) to deposit insoluble calcium salts either on mold surfaces or within the mold pores and liberate water-soluble sulfates. This action tends to destroy mold surface detail, retard the rate of water absorption from the slips, retard the rate of mold drying, and decrease mold strength. The length of the useful life of plaster molds employed in slip casting is therefore greatly influenced by the type and amount of deflocculent contained in the clay slips.

The present study was made to develop quantitative data on the effect of some of the more common deflocculents on the physical characteristics of pottery plaster molds. Of necessity, the scope of the investigation was limited, and several factors remain unexplored, such as the variation in deflocculent concentration, the combined use of two or more deflocculents, and the variation in mold-drying technique.

II. Experimental

Two-inch cubes were cast in brass molds from U. S. Gypsum Company No. 1 Pottery Plaster. The plaster was mixed at a ratio of 75 water : 100 plaster by weight with a 1760-r.p.m. Lightning Mixer equipped with a 3-inch three-blade propeller. These cubes were used for tests on surface appearance, weight loss, compressive strength, surface hardness, rate of drying, and rate of absorption. Slabs 4 by 4 by $1/2$ inches were cast from the same mix for rate-of-calcination tests.

Set cubes and slabs were dried to constant weight at 105°F. After drying, test specimens were allowed to soak in 1% deflocculent solutions for 6 hours, the solution volume averaging 200 cc. per 2-inch cube. The deflocculent chemicals employed were sodium carbonate, sodium silicate,† tetrasodium pyrophosphate, and ammonium

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944 (White Wares Division). Received April 4, 1944.

† Ratio of $1Na_2O:3.22SiO_2$ in sodium silicate used; specific gravity 1.38, Baumé 40.

tartrate. The solution temperature during soaking cycles was maintained at 70° to 75°F. One group of molds soaked in water was employed as a control. At the end of the 6-hour soaking period, the molds were removed, rinsed with water, weighed, and dried at 105°F. to constant weight. The cycle was repeated ten times, fresh deflocculent solutions being used for each cycle. After five cycles, half of the cubes from each group were tested; the remaining half were tested at the completion of the ten-cycle treatment.

III. Surface Appearance

Distinct differences were obtained in type of surface attack with the various deflocculents (see Table I). After ten cycles, the surfaces appeared to be the same as after five cycles, except that the characteristics noted were intensified. Tetrasodium pyrophosphate had the least visible effect on surfaces. Surface attack was most pronounced with sodium carbonate.

TABLE I

MOLD SURFACE CONDITION AFTER FIVE CYCLES

Deflocculent solution	Surface appearance
Tap water	Surface smooth; slightly pitted due to erosion around pinholes.
Sodium carbonate	Irregular wavy surface; pronounced pitting; evidence of severe surface attack.
Sodium silicate	Surface fairly smooth; loose, scaly deposit of calcium silicate.
Tetrasodium pyrophosphate	Surface smooth; better than above; less surface attack and deposit; efflorescence on drying.
Ammonium tartrate	Surface stained yellow; fairly smooth; thin crystalline crust of calcium tartrate.

IV. Compressive Strength

Compressive strength was determined on each group of plaster cubes after five and ten immersion cycles. Cubes were tested while wet, as removed directly from the solutions, and after drying. Values reported in Table II are averages of four individual tests for each condition.

TABLE II

COMPRESSIVE STRENGTH (LB./SQ. IN.) OF PLASTER CUBES AFTER CYCLIC IMMERSION IN DEFLOCCULENT SOLUTIONS

	Treating medium (1% solution)					
	Untreated (plaster as cast)	Tap water	Sodium carbonate	Sodium silicate	Tetrasodium pyrophosphate	Ammonium tartrate
After 5 cycles						
Wet	704	680	490	800	690	720
Dried	1880	1850	1880	2080	2050	2290
After 10 cycles						
Wet		700	505	820	695	690
Dried		1840	1750	2200	2280	2340

With the exception of sodium carbonate, cyclic immersion of plaster in these deflocculent solutions slightly increases the strength of plaster molds, particularly dry strength. Wet strength is adversely affected by sodium carbonate. Strength increases are probably due to the deposition of insoluble calcium salts within the porous molds. Repeated immersion in water had little effect on either wet or dry strength.

V. Surface Hardness

Variations in surface hardness after five and ten cycles of immersion are shown in Table III. Surface hardness was determined with the Shore Instrument Manufacturing Company Monotron Hardness Tester, and results are expressed as kilograms load required to obtain a penetration of 0.01 inch, load applied on a steel ball 10 mm. in diameter. The values given are averages of twenty individual determinations; the cubes were tested wet, immediately after removal from the immersion solution, and after drying at the end of five and ten immersion cycles.

TABLE III

SURFACE HARDNESS OF PLASTER CUBES AFTER CYCLIC IMMERSION IN DEFLOCCULENT SOLUTIONS

	Treating medium (1% solution)					
	Untreated (plaster as cast)	Tap water	Sodium carbonate	Sodium silicate	Tetrasodium pyrophosphate	Ammonium tartrate
After 5 cycles						
Wet	7	8	7	10	7	8
Dried	14	18	22	21	20	21
After 10 cycles						
Wet		9	7	9	10	9
Dried		16	17	22	32	16

Surface hardness increases after cyclic immersion with all solutions, as compared with the original hardness of the fresh plaster. Increase in hardness is greater with the deflocculent solutions than with tap water. This hardness increase with tap water is probably due to the surface solution and recrystallization of gypsum, with the formation of larger gypsum crystals accompanied by a case-hardening surface effect. The greater dry hardness obtained with the treating chemicals is undoubtedly caused by the deposition of insoluble calcium salt films on the mold surfaces which are harder than the original gypsum. After ten immersion cycles, the increase in hardness is greatest with tetrasodium pyrophosphate, followed by sodium silicate.

VI. Material Loss or Gain

Results shown in Table IV show great differences between the various deflocculents in their solution action on set gypsum. Weight changes reported are on the basis of the dry weight of 2-inch cubes; the per cent change is the weight difference between the original dry weight and the weight after cyclic immersion, followed by redrying to constant weight. Cubes averaged 140 grams dry weight before treatment.

TABLE IV

MATERIAL LOSS OR GAIN OF PLASTER CUBES AFTER CYCLIC IMMERSION IN DEFLOCCULENT SOLUTIONS (%)

	Treating medium (1% solution)				
	Tap water	Sodium carbonate	Sodium silicate	Tetrasodium pyrophosphate	Ammonium tartrate
After 5 cycles	−0.7	−5.0	+1.4	+1.4	+0.7
After 10 cycles	−2.1	−11.4	+2.1	+1.4	+0.7

Material loss experienced after repeated immersion in water is due to the solubility effect of water on set gypsum.

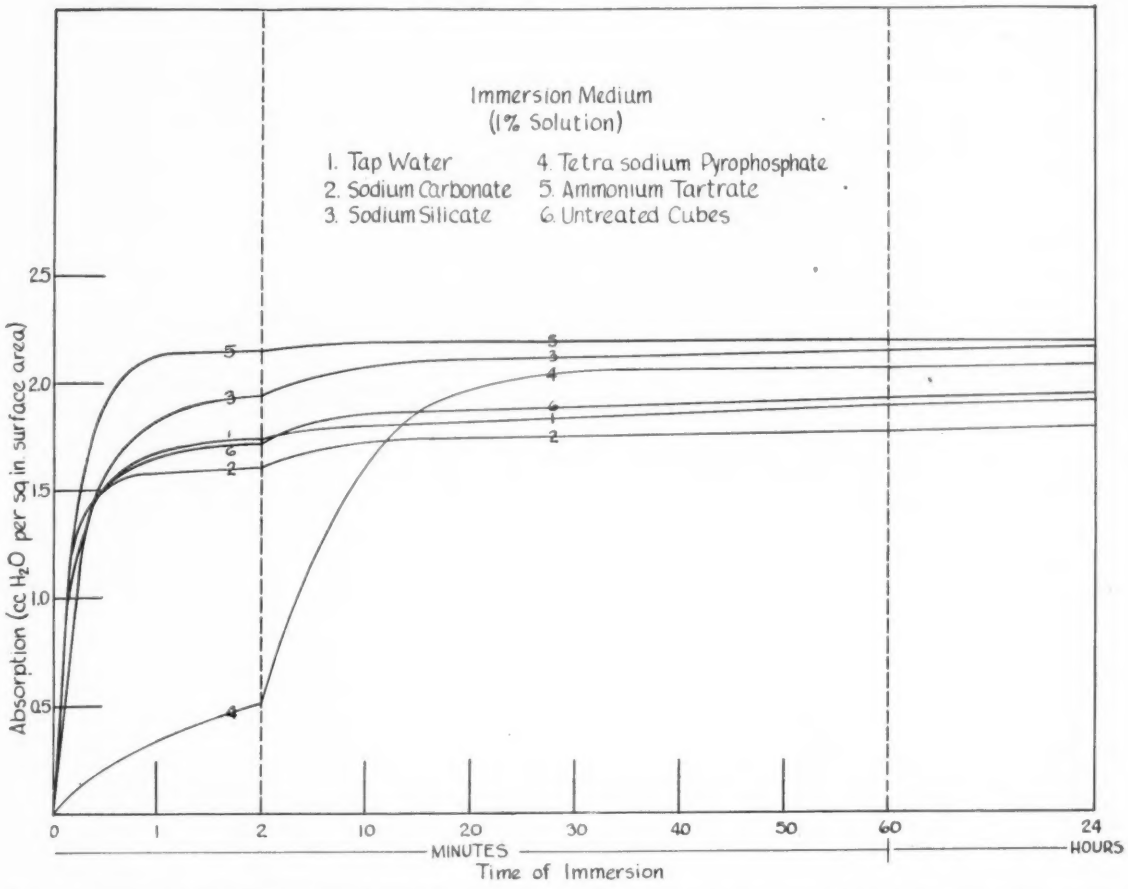

FIG. 1.—Rate of water absorption of dried plaster cubes after five immersion cycles in 1% deflocculent solutions.

Gypsum has a solubility of approximately 0.2 gram per 100 cc. of water at the temperatures of 70° to 75°F. employed in this investigation. Obviously, the values shown for per cent weight change are functions of the volume of water or solution employed to surface area of cubes immersed. Absolute values will vary as this ratio is varied.

Cubes immersed in the sodium carbonate solution suffered a dry material loss five times that of the loss obtained after similar immersion in tap water. This greater weight loss is probably due to the increased solubility of calcium sulfate in sodium sulfate, which is formed by interaction between sodium carbonate and the set gypsum. Immersion of cubes in solutions of sodium silicate, tetrasodium pyrophosphate, and ammonium tartrate resulted in actual increase in cube weight. Apparently, the deposition of insoluble calcium silicate, phosphate, and tartrate films protects the gypsum from appreciable solution action, at least under the experimental conditions employed. With these deflocculents, the weight of the precipitated insoluble calcium salts is greater than the weight of the gypsum lost by solution. Calcium carbonate formed in the presence of sodium carbonate apparently fails to provide this protective action.

VII. Rate of Absorption

Rate of absorption was determined on untreated cubes and cubes after five and ten cycles of immersion by completely immersing the dry cubes in water, followed by removal at suitable time increments and weighing. Results are expressed in Figs. 1 and 2 as cubic centimeters of water absorbed per square inch of surface area as a function of time.

Figure 1 illustrates the rate of absorption of cubes after five immersion cycles; Fig. 2 shows the rate of absorption after ten cycles.

The rate of absorption of plaster is but little affected by five immersion cycles in all deflocculents, with the exception of tetrasodium pyrophosphate. This phosphate has a marked retardative effect on the initial rate of absorption, but after 10 to 20 minutes, the total water absorbed is equal in amount to the water absorbed by cubes treated in water or other deflocculents. After ten immersion cycles, cubes treated in ammonium tartrate solution also had their initial rate of absorption retarded, but not nearly to the same degree as with the pyrophosphate. Sodium silicate appears actually to increase the absorptive action of plaster casts. The initial rate of absorption was slower with all deflocculents after ten cycles than after five cycles.

Ninety per cent of the total absorption is obtained within one to two minutes after the start of the test. All cubes had about the same absorption capacity after a 24-hour immersion time. Differences between initial absorption rates are undoubtedly due to physical differences in the nature of the precipitated films.

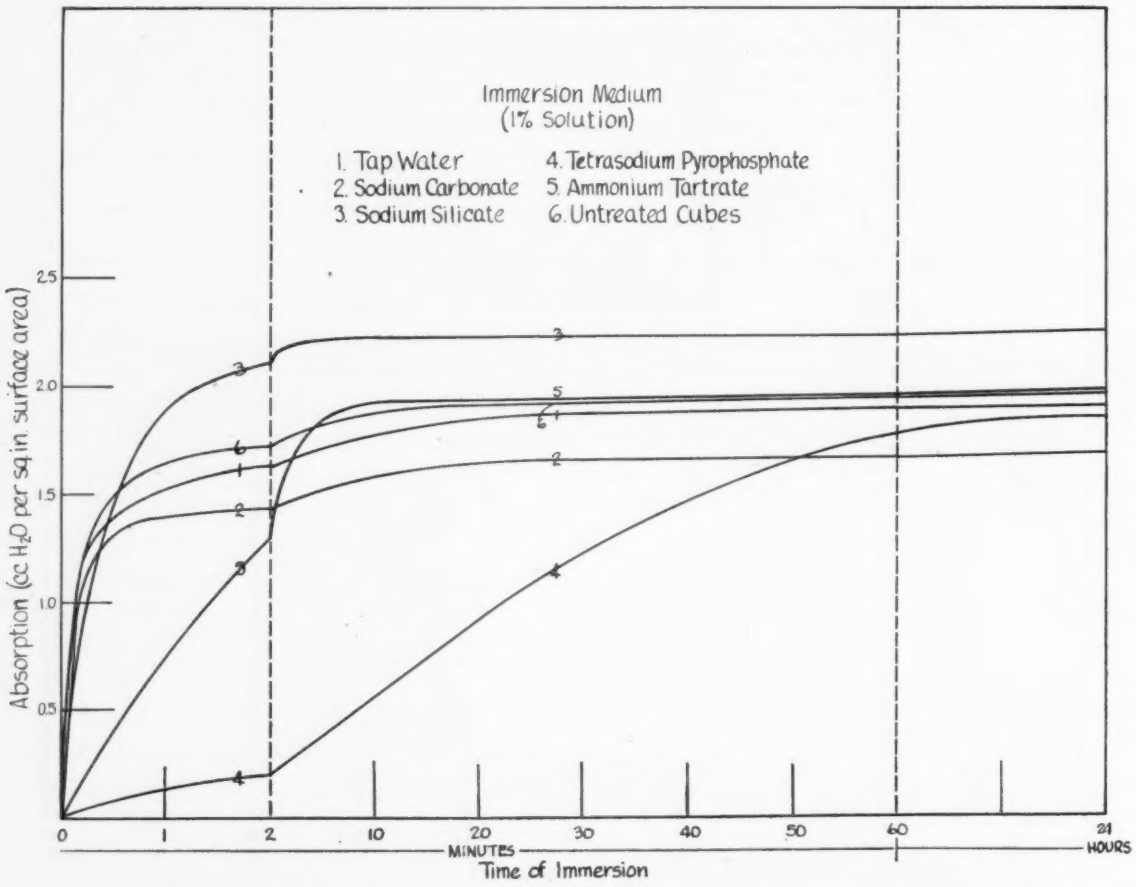

FIG. 2.—Rate of water absorption of dried plaster cubes after ten immersion cycles in 1% deflocculent solutions.

VIII. Rate of Drying

No quantitative data were obtained on the time required to dry plaster cubes after each immersion cycle. As the number of immersion cycles increased, the time required for drying of the cubes also increased. Drying for two days at 105°F. is usually sufficient to completely dry the untreated cubes or cubes immersed in water. Cubes treated in sodium silicate after ten cycles required approximately seven days to dry completely under these conditions. Cubes treated in pyrophosphate and ammonium tartrate required a drying time of three weeks. Sealing of the surfaces by crystallization of the chemicals upon evaporation during drying is undoubtedly responsible for this phenomenon.

IX. Rate of Calcination

Under severe drying conditions, set gypsum molds will become dehydrated, or calcined, the set gypsum reverting to its original hemihydrate form, $CaSO_4 \cdot {}^1/_2H_2O$. Mold calcination is evidenced in potteries by the formation of soft, chalky surfaces and the destruction of surface detail. Factors affecting mold calcination have been presented by Dailey and Nies.[1]

Susceptibility to calcination of set gypsum may be influenced considerably by the presence of small amounts of various chemicals. To determine the effect of deflocculents on this important characteristic, 4- by 4- by $^1/_2$-inch plaster slabs were immersed in the same manner as the cubes in solutions of various deflocculents. After five and ten immersion cycles, the slabs were rinsed with water, dried to constant weight at 105°F., and placed in a Carrier Air Conditioner oven maintained at 150°F., 15% relative humidity, in air circulating past the slabs at an average rate of 300 feet per minute. The degree of calcination was calculated by the following weight loss of the slabs due to loss of combined water as a function of time. Results are expressed as the per cent total gypsum dehydrated and are illustrated in Figs. 3 and 4 as the rate of calcination after five and ten cycles, respectively, in the various deflocculent solutions.

Susceptibility to calcination of set gypsum markedly decreased after cyclic immersion in ordinary tap water, as compared with calcination susceptibility on the original set and dried gypsum slab without further immersion in water. All of the deflocculents slightly increased the tendency to calcination as compared with the effect of water alone. The extent of this effect is slight, however, and it would probably be of no practical importance in the average pottery. Slabs treated in tetrasodium pyrophosphate calcined slightly faster than slabs treated in

[1] M. C. Dailey and B. E. Nies, "Some Factors Affecting Plaster Mold Life," *Bull. Amer. Ceram. Soc.*, **19** [9] 323–29 (1940).

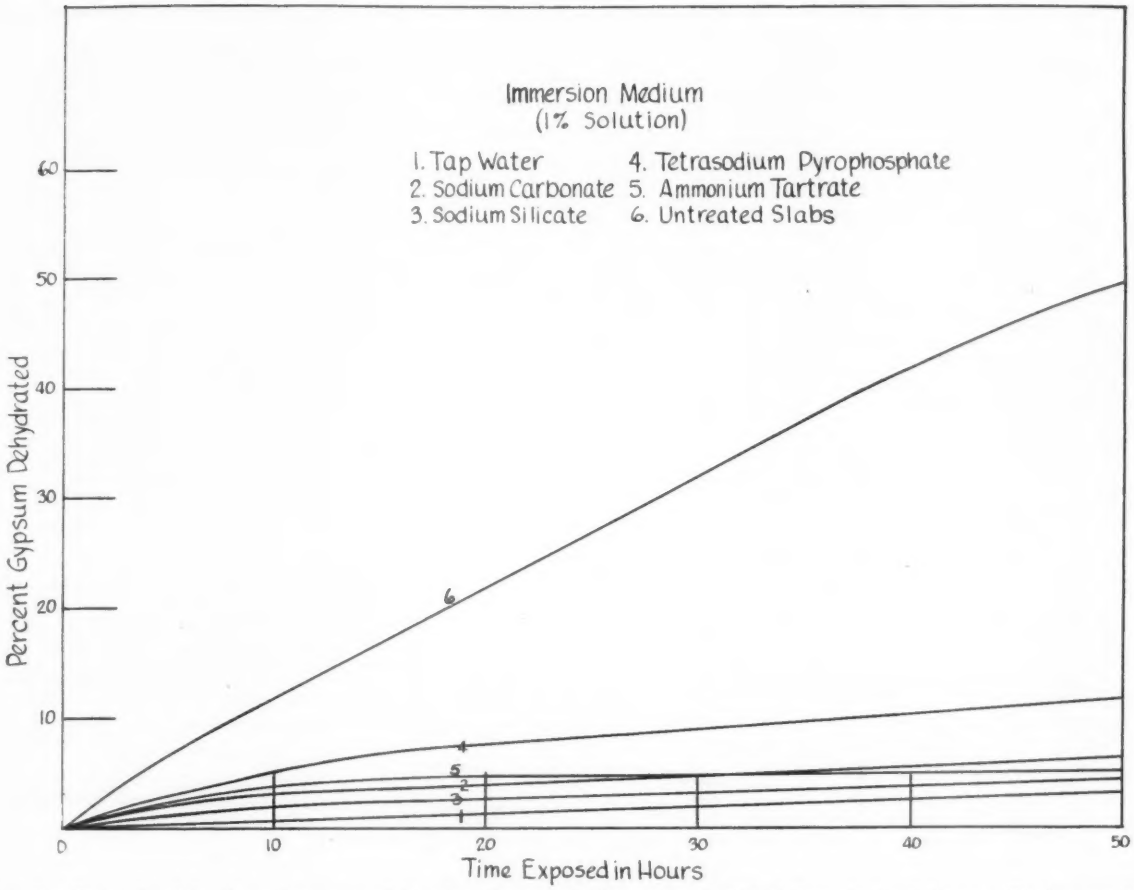

FIG. 3.—Rate of calcination of gypsum slabs after five immersion cycles in 1% deflocculent solutions. Drying conditions: air at 150°F., 15% relative humidity.

the other materials. Increasing the number of immersions from five to ten had but little effect on the susceptibility to calcination.

The values shown on the increased resistance to calcination of the set gypsum after several cycles of wetting and drying should be of interest to the industry and may profitably be employed as a guide in establishing proper mold-drying technique. Freshly made molds should be handled carefully and dried under moderate conditions. After several cycles of use, such molds may be subjected to more vigorous drying conditions without great danger of burning or calcining.

X. Discussion of Results

As a result of this study, no preferred types of deflocculent can be recommended for use in ceramic casting, so far as action on plaster molds is concerned. Sodium carbonate accelerates mold surface attack and decreases mold strength to a greater degree than the other deflocculents studied. Tetrasodium pyrophosphate has an adverse effect on the initial rate of absorption, but this may not be of practical importance if sufficient time can be allowed for building up desired body thickness. Weaker concentrations of the salt as normally employed should have less film-forming tendency and less effect on the absorption rate than the 1% solution used in this work. Sodium silicate, pyrophosphate, and ammonium tartrate greatly decrease the rate at which molds will dry, and potteries should recognize the fact that a longer time will be required to dry molds which have been in service for some time.

The limitations of this study are recognized by the authors, in that the deflocculent concentrations employed were far greater than those normally encountered in actual practice. Solution concentrations were purposely made high to obtain accelerated effects. It is recognized further that in actual use the deflocculent solution enters the mold face, travels through the mold, and is normally evaporated from mold back surfaces. All tests were made with molds completely immersed, followed by drying from all exposed surfaces. In normal pottery use, sodium sulfate formed by the reaction between the deflocculent and the gypsum is transferred through the mold by the agency of solution and deposited during the drying cycle as efflorescence on mold backs. Despite the differences between commercial practice and our experimental procedures, the results presented may be of some value in demonstrating the effects which deflocculent chemicals exert on the physical characteristics of plaster molds.

XI. Recommendations

The following recommendations are made both from results listed in this paper and from observations and experiences in the field.

(1) For maximum mold life, employ deflocculents in

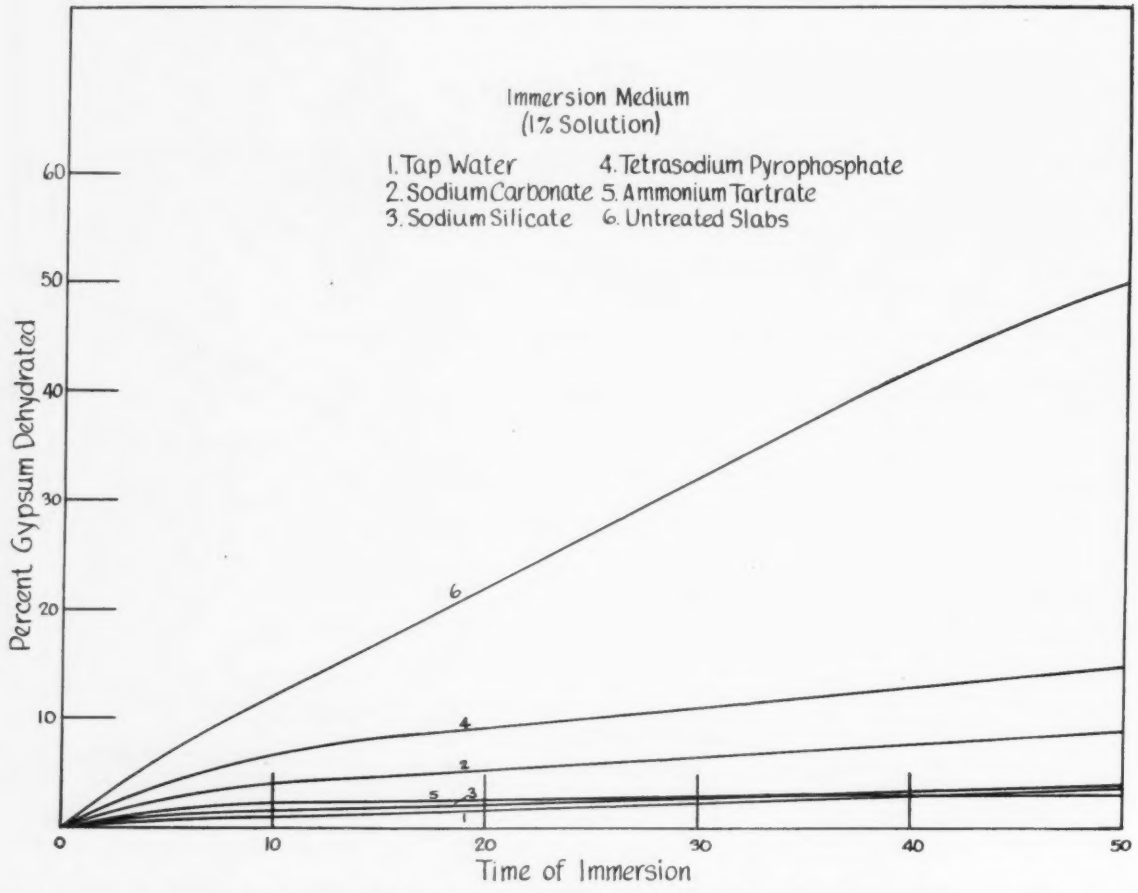

FIG. 4.—Rate of calcination of gypsum slabs after ten immersion cycles in 1% deflocculent solutions. Drying conditions same as in Fig. 3.

the minimum quantity required to obtain proper clay casting characteristics.

(2) When sodium carbonate and sodium silicate are employed in combination as a deflocculent, the amount of carbonate should be reduced to the absolute minimum consistent with good casting control. Silicate in general has a less eroding effect on mold surfaces than carbonate. Practical experience indicates that mold life can be extended as much as 50% with sodium silicate as compared with carbonate. Pitting from erosion due to chemical action is decreased greatly.

(3) Molds employed for slip casting should have their working surfaces protected during drying so that all drying is forced through the back of the molds. This serves to remove soluble salts from the working faces and to concentrate efflorescence deposits on the back surfaces where they do the least harm and may be removed if necessary.

(4) Mold performance can be improved by the periodic removal of efflorescence encrustation from the mold back surfaces, either mechanically or by rinsing with water.

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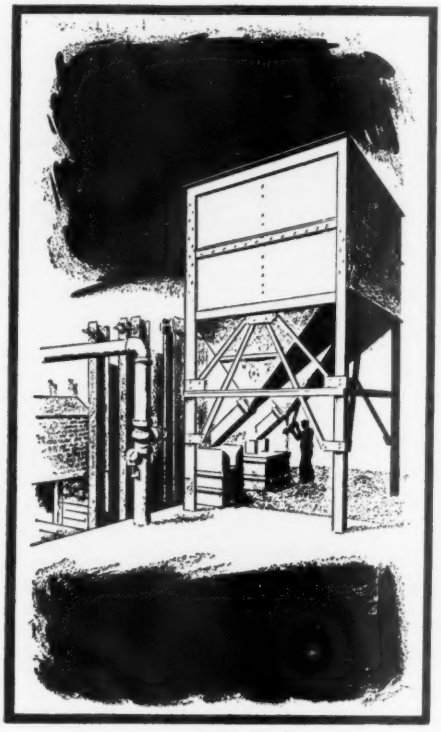
Phaon Hilborn Bates, chief of the Clay and Silicate Products Division of the National Bureau of Standards, Washington, D. C., was elected president of the American Society for Testing Materials at the Forty-Seventh Annual Meeting of that society held June 28 in New York, N. Y.

Mr. Bates has been chairman of A.S.T.M. Committee C-1 on Cement since 1926 and has been active in other society work. He is a past-president of the American Concrete Institute and was awarded the Turner Medal by the Institute in 1939 for contributions to science, direction of research, and outstanding leadership in advancing the intelligent utilization of cement and concrete. In 1940, he was the A.S.T.M. Edgar Marburg Lecturer on the subject "Portland Cement—Theories (Proved and Otherwise) and Specifications." He was a member of the Executive Committee from 1937 to 1939 and has just completed a term as vice-president.

A biographical sketch and photo of Mr. Bates have appeared in a previous issue of *The Bulletin* (see *Bull. Amer. Ceram. Soc.*, **21** [10] 227 (1942)). Mr. Bates is a Charter Fellow of The American Ceramic Society.



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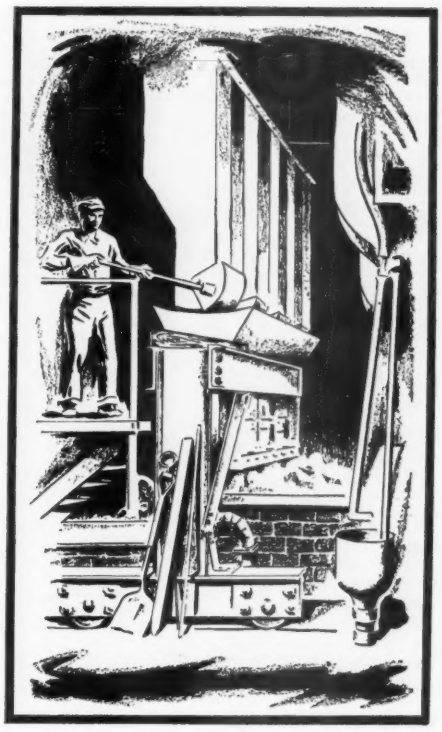

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Vitro Mfg. Co.

Kilns, China (Decorating)
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.—Allied Engineering Div.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Kilns (Electric, Circular, Tunnel)
Ferro Enamel Corp.—Allied Engineering Div.
Harrop Ceramic Service Co.
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Carborundum Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.—Ceramic Supply Div.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

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Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
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Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co., Inc.
Foote Mineral Co.
Hommel, O., Co., Inc.

Lithium Minerals
Foote Mineral Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.

Magnesite
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
Hommel, O., Co., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Manganese
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Ferro Enamel Corp.
Foote Mineral Co.
Hommel, O., Co., Inc.

Manganese (Oxide)
Corhart Refractories Co.
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

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Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.

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American Rolling Mill Co.

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Microscopes (Stereoscopic)
Bausch & Lomb Optical Co.
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Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
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Pennsylvania Salt Mfg. Co.

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Harshaw Chemical Co.
Hommel, O., Co., Inc.

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Harshaw Chemical Co.
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Nitre
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Oxides
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
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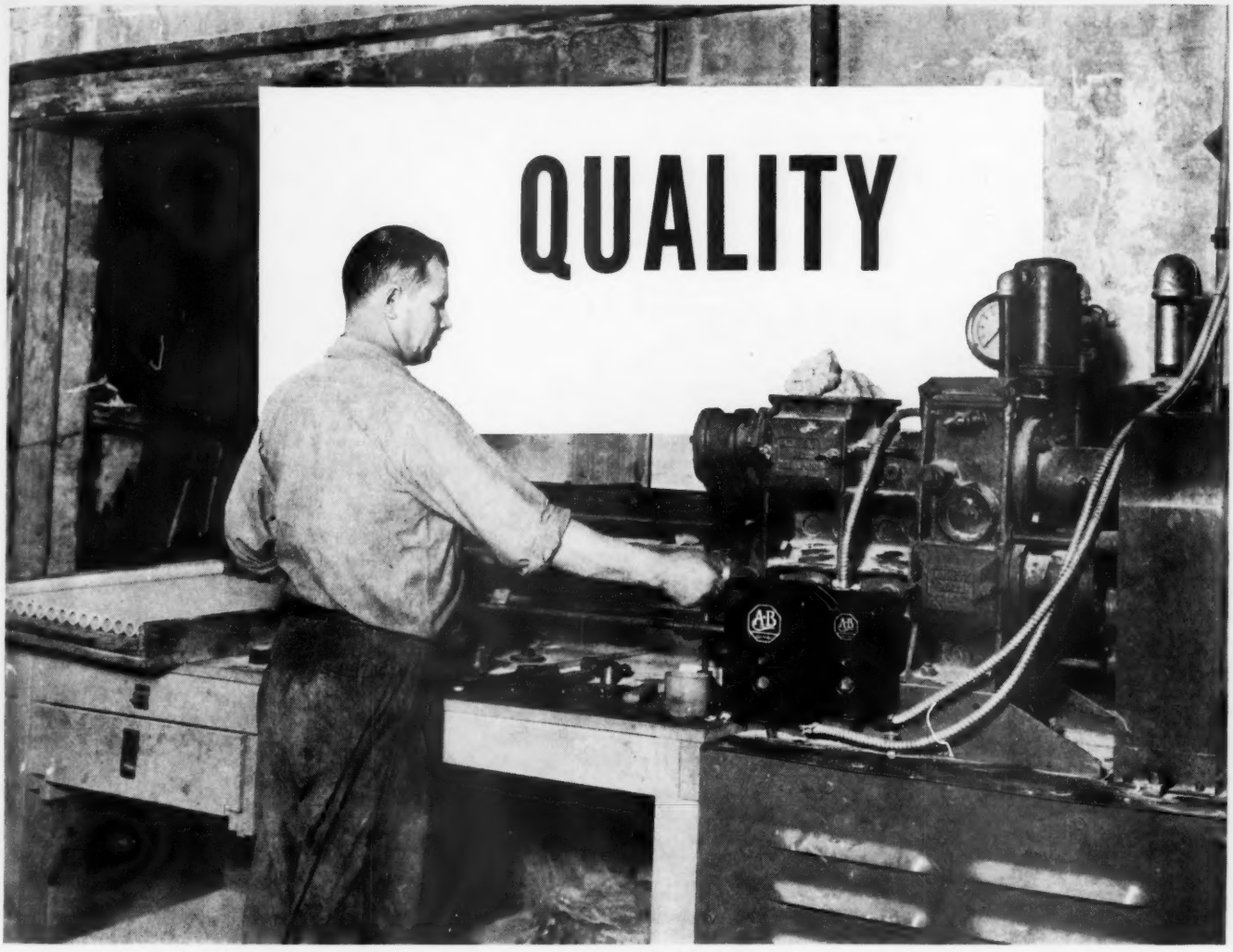

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Harshaw Chemical Co.
Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
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Harshaw Chemical Co.
Hommel, O., Co., Inc.
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Leeds & Northrup Co.
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Drakenfeld, B. F., & Co., Inc.
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Harshaw Chemical Co.
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Uranium Oxide (Yellow-Orange-Black)
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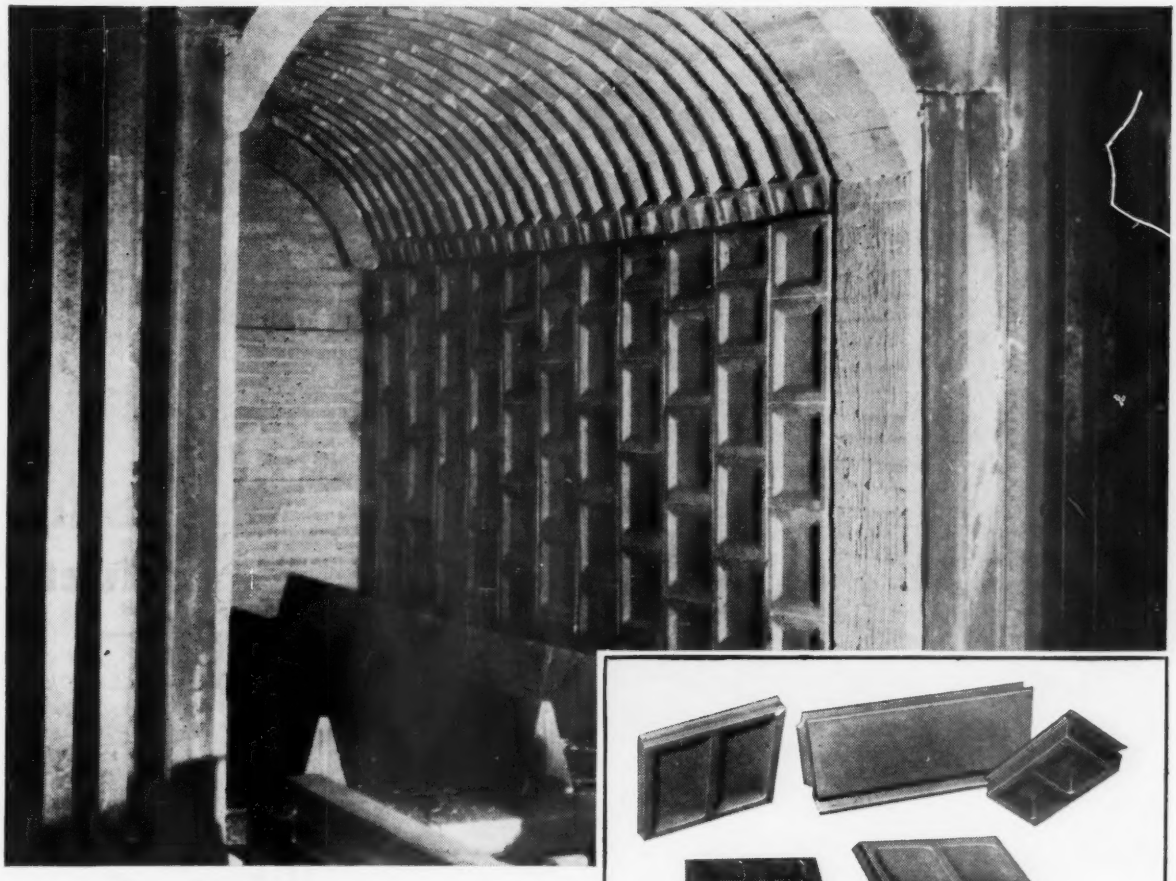

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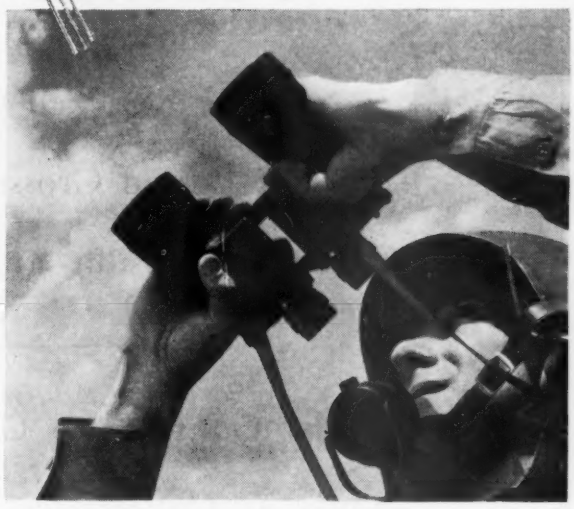

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